

COVER PAGE

Site Number: 0978020001
Site Name: Zion Site 1 Phase A Landfill
Category: 24D RCRA Permits Administrative Record
Document Date: 09/25/2025
Permit ID:
Permit Log: B-23R2

Volume 4 of 7

THIS PAGE FOR IMAGING PURPOSES

ADMINISTRATIVE RECORD

for

Zion Site 1 Landfill, Phase A

0978020001 – Lake County

ILD980700728

Log No. B-23R2

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Volume 3 of 4

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IEPA - DIVISION OF RECORDS MANAGEMENT
RELEASABLE

OCT 21 2025

REVIEWER: MED

Appendix E-3

Construction Documentation – Clay Division Berm and Slurry Wall

IEPA - DIVISION OF RECORDS MANAGEMENT
RELEASABLE

OCT 21 2025

REVIEWER: MED

Appendix E-3A

Construction Documentation, October 1991

■ Construction Documentation

**Winthrop Harbor
Clay Division Berm**

Prepared for:



**Browning-Ferris Industries
of Illinois, Inc.**

October 1991



CONSTRUCTION DOCUMENTATION

**WINTHROP HARBOR
CLAY DIVISION BERM**

PREPARED FOR

BROWNING-FERRIS INDUSTRIES OF ILLINOIS, INC.

October 1991

**Donohue & Associates, Inc.
Engineers/Architects/Scientists
4738 North 40th Street
Sheboygan, WI 53083**

Donohue Project No. 18929

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RP/BFIWINOC/AA1

1.0 INTRODUCTION

This report covers documentation of the construction, testing, and inspection for the clay division berm at Winthrop Harbor Landfill, Zion, Illinois. Project development involved construction of an approximately 1,200-foot long clay division berm. The approximate limits of the clay berm and project stationing are shown on the "Existing Site Conditions" drawing, provided in Appendix A.

Donohue & Associates, Inc., was present during construction of the clay division berm to provide construction quality assurance services including: field observations and testing, collection of soil samples for laboratory testing, and daily documentation of construction activities. Construction quality assurance services are summarized in more detail in the following discussions.

This report constitutes certification of substantial compliance with Illinois Environmental Protection Agency (IEPA) Supplemental Permit No. 1985-226-SP, provided in Appendix B.

Personnel involved in project development and construction are as follows:

- o Browning-Ferris Industries of Illinois, Inc. - Owner
Robert Piet - Regional Landfill Manager
John Dixon - Vice President of Operations
- o Donohue & Associates, Inc. - Construction Quality Assurance
Nancy Richardson - Project Manager
Richard E. Fedler - Certifying Engineer
David Marthaler - Inspector
- o Ryan, Inc. - Earthwork Contractor
Mike Vaudrevil - Supervisor
- o Giles Engineering Associates, Inc. - Soil Testing Laboratory
Don Mich - Laboratory Supervisor

2.0 CONSTRUCTION ACTIVITIES

Construction for the clay division berm began on September 23, 1991. Ryan, Inc., performed all related earthwork activities. The location of the clay division berm was determined and set by BFI and Ryan, Inc. Fill materials utilized for construction generally consisted of a mixture of gray silty clays obtained from an on-site borrow area. Placement of clay was performed utilizing 14-cubic yard scrapers. After placement, each lift of clay was leveled by a D-8 dozer, disced, and compacted by a self-propelled sheepsfoot roller. Compacted lift thickness was approximately 6 inches. Clay lifts were tested for compaction in accordance with project specifications identified in Supplemental Permit No. 1985-226-SP, a copy of which is provided in Appendix B. Clay placement operations were completed on October 3, 1991.

Total volume of clay placed was approximately 17,500 in-place cubic yards. Clay volume calculations are provided in Appendix C. Project station cross sections are provided in Appendix D. Photographs showing clay division berm construction activities are provided in Appendix E.

3.0 INSPECTION ACTIVITIES

Donohue & Associates, Inc., provided continuous inspection and documentation services during construction of the clay division berm between the period of September 23, through October 3, 1991. During this period, Donohue's inspector visually observed construction activities, performed in-field density tests on compacted clay, documented location of the berm as determined by BFI and Ryan, Inc., and collected soil samples for laboratory testing. Observations were recorded on daily field reports.

A total of 93 in-field density tests were performed by Donohue's inspector to monitor in-place clay moisture and density values. Clay density and moisture content were measured with a Troxler Nuclear Density/Moisture Gauge in accordance with ASTM D2922.

Measurements were performed on lifts at approximately 200-foot spacings. Materials used to construct the berm were obtained from an on-site borrow area, referenced as the south cell area. All clay material utilized for construction was obtained from the south cell borrow area. Initial laboratory data from analyses performed on a sample of clay material indicated a maximum dry density of 119.1 pcf. A maximum dry density value of 119.1 pcf was utilized at the start of construction to perform in-field density tests. Additional laboratory data received on October 3, 1991, indicated maximum dry densities of 120.4 pcf and 121.2 pcf. A maximum dry density value of 121.2 pcf was utilized for completion of in-field density testing.

The area of the clay division berm located from 11600 North to 11700 North received additional lifts of clay material to reach finished elevation for the current lift of clay being placed. This is represented on the project station cross sections provided in Appendix D. Field density testing of the additional material was performed in accordance with project specifications. Refer to Appendix F for results of additional density tests performed between the stations identified.

Density test results indicated compaction and moisture levels meeting or exceeding project specifications of 95 percent of Standard Proctor. Areas having failing tests were moisture conditioned (if necessary), recompact, and retested. Field density test results are provided in Appendix F.

Clay division berm grade documentation was periodically performed to aid in estimating clay quantities. All documentation was referenced from site grid stationing. Stationing is shown on the drawing, "Existing Site Conditions," provided in Appendix A.

4.0 SOIL TESTING

Laboratory tests were performed on clay soil samples to verify index properties (i.e., Atterberg Limits and P200 content) and permeability in accordance with project specifications and IEPA Supplemental Permit No. 1985-226-SP. Laboratory soil test results are provided in Appendix G and summarized in Table 1.

TABLE 1
SOIL LABORATORY TEST RESULTS
WINTHROP HARBOR
CLAY DIVISION BERM
October 1991

<u>Sample No.*</u>	<u>Date Sampled</u>	<u>Location and Description</u>	<u>Standard Proctor PCF/% H₂O</u>	<u>Atterberg Limits</u>			<u>USCS</u>	<u>Permeability cm/sec</u>	<u>% Passing #200 Sieve</u>
1R	09-20-91	Borrow Area	119.1 @ 13.5	--	--	--	CL	--	--
2R	09-25-91	11000N, 9375E	120.4 @ 12.6	26	13	13	CL	--	85.3
3R	09-30-91	11300N, 9375E	121.2 @ 12.6	26	13	13	CL	--	85.5
4R	10-03-91	11700N, 9375E	121.9 @ 12.4	26	13	13	CL	--	85.3
1U	09-26-91	10700N, 9375E	--	26	13	13	CL	1x10 ⁻⁸	86.1
2U	09-30-91	11050N, 9375E	--	--	--	--	CL	8x10 ⁻⁹	--
3U	10-03-91	11800N, 9375E	--	25	14	11	CL	8x10 ⁻⁹	79.3

NOTES:

1. An "R" designation under Sample No. indicates collection of a bulk soil sample.
2. A "U" designation under Sample No. indicates collection of an undisturbed (shelby tube) soil sample.

RP/BFIWINOC/AA2

A total of 5 tests were performed for Atterberg Limits and P200 content determinations. Test results indicated that Plasticity Indices (PI) and P200 contents ranged from 11 to 13 and 79.3 to 86.1 percent, respectively. Based on laboratory index tests, the material utilized to construct the berm is classified "Gray Silty Clay" (CL) as determined by the Unified Soil Classification System.

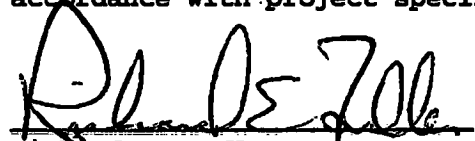
A total of three relatively undisturbed clay samples were recovered by 3-inch Shelby tubes for laboratory hydraulic conductivity testing. Hydraulic conductivity test results indicate permeabilities of the clay samples of 1×10^{-8} cm/sec, 8×10^{-9} cm/sec and 8×10^{-9} cm/sec, all of which are less than the required maximum of 1×10^{-7} cm/sec.

5.0 CONCLUSION

During construction of the clay division berm at the Winthrop Harbor facility, Donohue performed construction quality assurance services. These services included field observations and clay density/moisture testing, and collection of soil samples for laboratory testing. In summary, field and laboratory test results showed substantial compliance to project specifications, indicating construction of the clay division berm was performed in a satisfactory manner.

6.0 CERTIFICATION

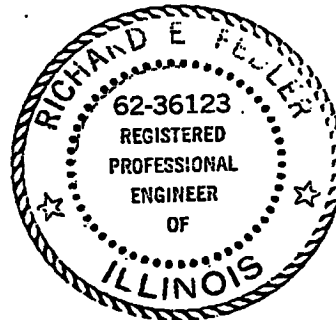
Based on our professional judgment on information obtained through on-site observations and field and laboratory soil test results, the clay division berm for the Winthrop Harbor facility was constructed in substantial accordance with project specifications.



Richard E. Fedler, P.E.
Certifying Engineer



Nancy J. Richardson, P.E.
Project Manager



RP/BFIWINOC/AA1

APPENDIX A
EXISTING SITE CONDITIONS

APPENDIX B

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY SUPPLEMENTAL PERMIT



Illinois Environmental Protection Agency • 2200 Churchill Road, Springfield, IL 62706

217/782-6762

Refer to: 0978020001 — Lake County
Winthrop Harbor/BFI #1
Supplemental Permit No. 1985-226-SP
Log Nos. 1985-090 and 1985-226

March 20, 1986

Browning-Ferris Industries
1827 Walden Office Square, Suite 107
Schaumburg, Illinois 60195

Gentlemen:

Supplemental permit is hereby granted to Browning-Ferris Industries, as owner and operator, to construct a berm along the eastern boundary of the above-referenced solid waste management site and to deposit non-hazardous waste in the area between this berm and the existing contours of the site. Final plans, specifications, application and supporting documents as submitted and approved shall constitute part of this permit and are identified in the records of the Illinois Environmental Protection Agency, Division of Land Pollution Control by the permit number and log number designated in the heading above.

This supplemental permit is issued subject to the standard conditions attached hereto and incorporated herein by reference, and further subject to the following special conditions:

1. In case of conflict between the application and plans submitted and these special conditions, the special conditions of this permit shall govern development and operation of the subject site.
2. Only nonhazardous wastes may be disposed in the area which is the subject of this permit.
3. After receipt at the site, but prior to disposal, every container of waste to be disposed in this area shall be sampled and analyzed by the paint filter test described in 35 Ill. Adm. Code 729.320. No wastes that yield fluid may be deposited in this area.
4. The diversion berm shall be constructed in accordance with the specifications identified in the document entitled "Slope Stability Analysis, Winthrop Harbor Landfill Nos. 1 & 2, Waukegan, Illinois." by Donohue and Associates, dated December, 1985. To ensure these specifications are met, the Construction Documentation Program in Appendix B of this document shall be adhered to, with the following exceptions:



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- a. Lifts of soil no more than nine inches thick (+) shall be used in constructing the berms;
 - b. Each lift shall be disced prior to compacting;
 - c. The soil placed in each lift shall be approximately three to five percent above the optimum moisture content to ensure the desired permeability is obtained upon compaction. If the moisture content of the soil excavated for use is below this level, water shall be added to obtain the desired moisture content.
 - d. Each lift shall be compacted to 95% of the Standard Proctor density (ASTM: D698);
 - e. The field density of each compacted lift shall be determined on 200 feet intervals. ASTM methods shall be used in making this determination;
 - f. One lab moisture density test shall be conducted for every 5000 cubic yards of soil used in constructing the berm, or when the borrow soil changes. The P200, clay content (less than 0.002 mm), grain size distribution curve, Atterburg limits and USCS soil classification shall be determined at the same frequency.
 - g. Provisions shall be made to key the bottom of each successive ten foot berm into the top of the lower berm. This may include scarifying and wetting the top of the lower berm prior to placing the initial lift of the upper berm. Other procedures may also be used to key the upper berm into the lower berm.
5. A registered professional engineer shall certify that the soil used in the construction of the berm:
- a. Is compacted to a minimum density which is 95 percent of the Standard Proctor Density (ASTM:D698);
 - b. Has an in-place permeability no greater than 1×10^{-7} cm/sec.

This certification shall be submitted to the Agency, as described in Special Condition No. 6 below. A report from a registered professional engineer documenting that the berm was constructed in accordance with the procedures set forth in Special Condition No. 4 above shall also be submitted to the Agency. These documents shall be developed each time a portion of the berm is constructed, and shall be submitted to the Agency before waste is placed against the newly constructed berm.



Illinois Environmental Protection Agency • 2200 Churchill Road, Springfield, IL 62706

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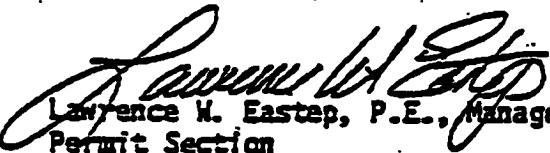
6. Unless otherwise indicated, all certifications, logs, reports and plan sheets which are required to be submitted to the Agency by the permittee shall be mailed to the following address:

Illinois Environmental Protection Agency
Compliance Monitoring Section
Division of Land Pollution Control -- #24
2200 Churchill Road
Springfield, Illinois 62706

7. Prior to placing waste against a portion of the newly constructed berm, the berm shall be inspected and approved by the Field Operations Section of this Division.

Except as modified in the above documents and in any supplemental permits issued by the Agency, this site shall be developed and operated in accordance with the terms and conditions of Permit No. 1975-53-OP, dated November 11, 1975.

Very truly yours,


Lawrence W. Eastep, P.E., Manager
Permit Section
Division of Land Pollution Control

LWE:JKM:rd0607F/1-3

Attachment

cc: Division File
Northern Region
Donohue and Associates
Fred Prillaman

APPENDIX C
VOLUME CALCULATIONS

VOLUME COMPUTATIONS

CLIENT BF1 PAGE NO. 1/2**Donohue**
Engineers & ArchitectsPROJECT WAUK. CLAY BERM PROJECT NO. 18222DATE 10-18-91 BY NJR CHECKED BY _____CUT OR FILL MATERIAL CLAY
CIRCLE ONE:*CHED Jas*

STATION	SECTION LIMITS	DISTANCE (FT)	END AREA (FT ²)	TOTAL OF END AREAS (FT ²)	AVERAGE END AREA (FT ²)	VOLUME (YD ³)
10485			0			
		15		121	61	34
10500			121			
		50		238	119	220
10550			117			
		50		418	209	327
10600			301			
		100		644	322	1193
10700			343			
		100		661	331	1226
10800			318			
		100		653	327	1211
10900			335			
		100		667	334	1237
11000			332			
		100		685	343	1270
11100			353			
		100		669	335	1241
11200			316			
		100		658	329	1219
11300			342			

COMMENTS:

VOLUME COMPUTATIONS

Donohue
Engineers & Architects

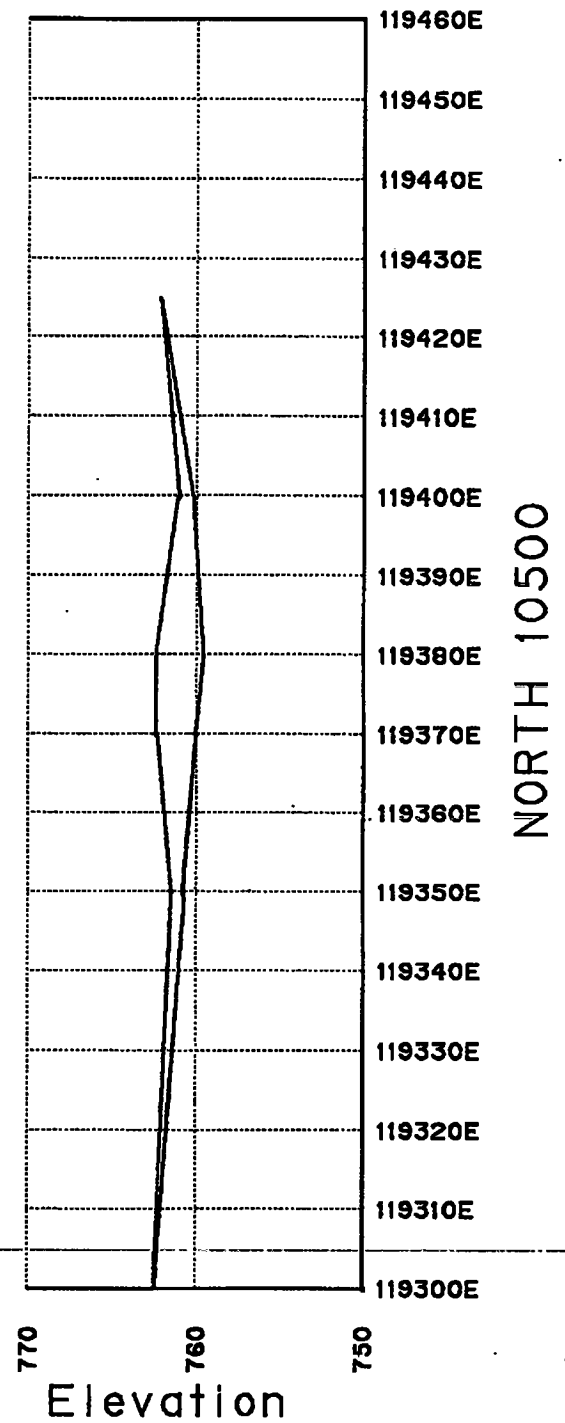
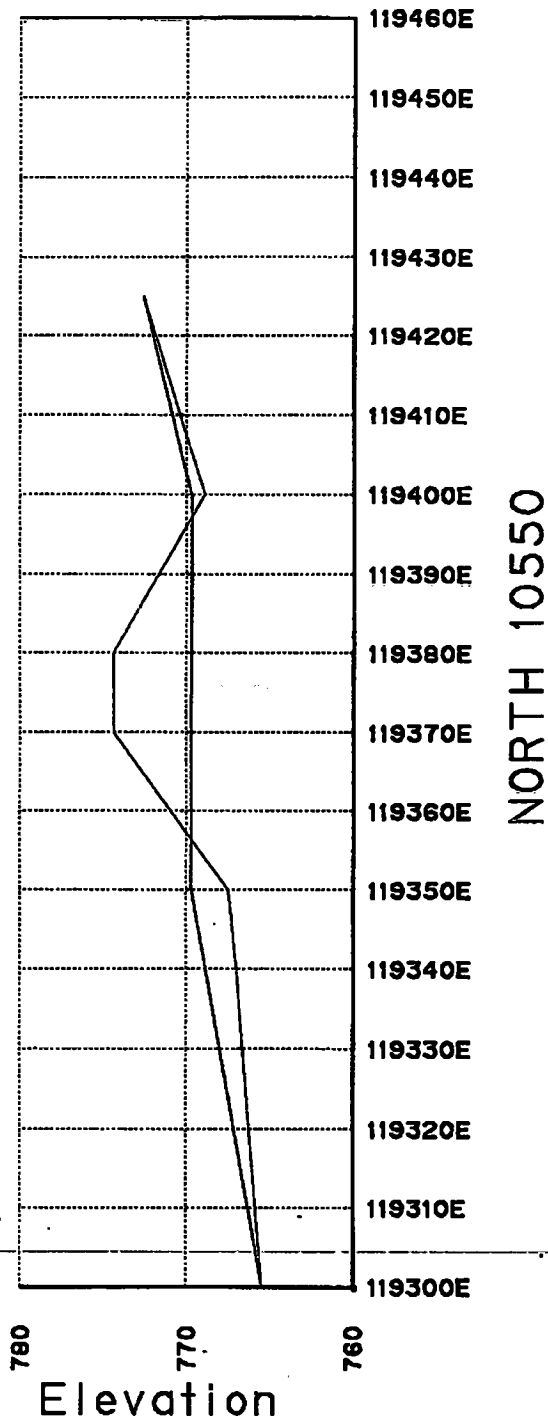
CLIENT BFI PAGE NO. 2/2PROJECT WAUK. CLAY BERM PROJECT NO. 12929DATE 10-18-91 BY NJK CHECKED BY _____CUT OR FILL MATERIAL CLAY
CIRCLE ONE

STATION	SECTION LIMITS	DISTANCE (FT)	END AREA (FT ²)	TOTAL OF END AREAS (FT ²)	AVERAGE END AREA (FT ²)	VOLUME (YD ³)
11300			342			
		73		769	385	1041
11373			427			
		27		810	405	405
11400			383			
		100		717	359	1330
11500			334			
		100		703	352	1303
11600			369			
		35		1138	569	738
11635			769			
		65		1704	852	2051
11700			935			
		100		935	468	1733
11800			0			

COMMENTS:

TOTAL = 17,844 yd³
 $\approx$ 17,850 yd³

APPENDIX D
CLAY DIVISION BERM CROSS SECTIONS



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CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

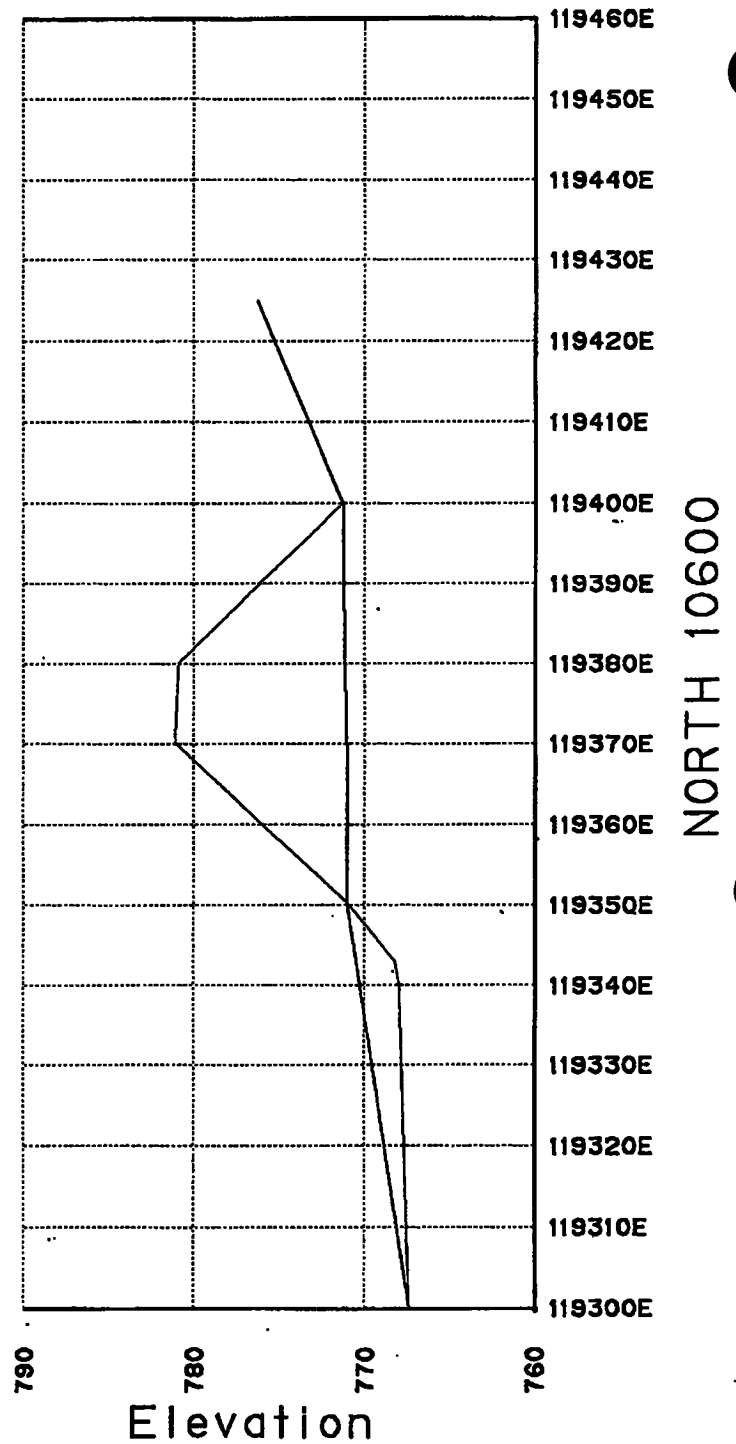
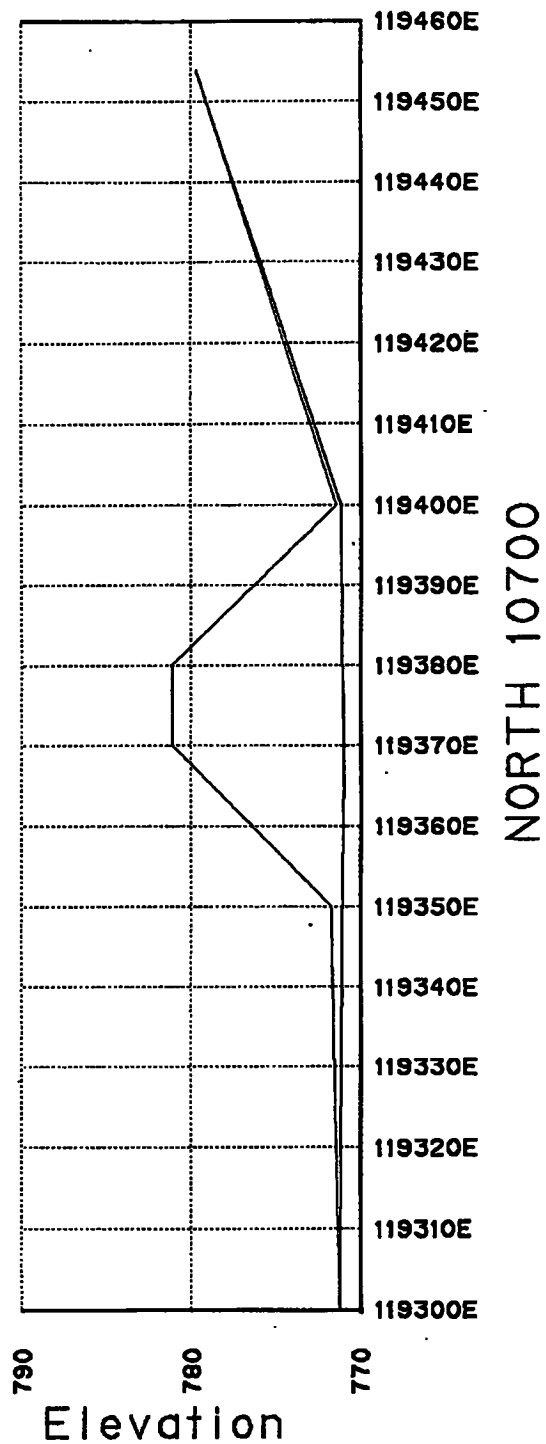
OCTOBER, 1991

Donohue

ENGINEERS

ARCHITECTS

SCIENTISTS

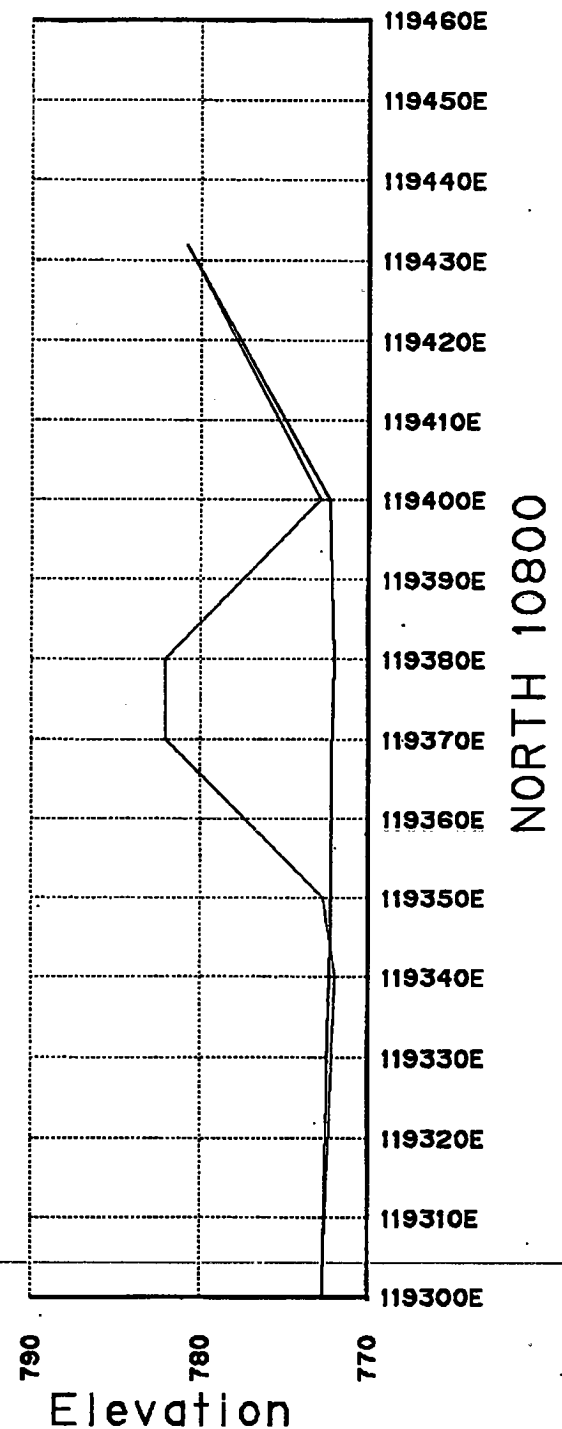
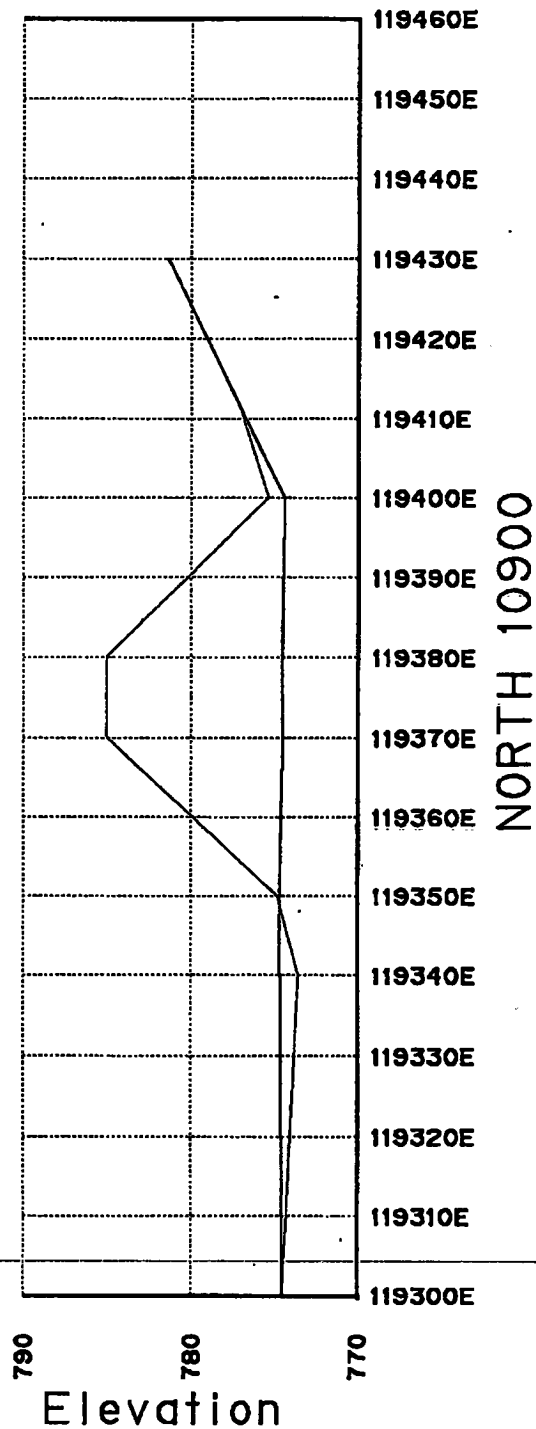


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CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

OCTOBER, 1991

Donohue ENGINEERS
ARCHITECTS
SCIENTISTS



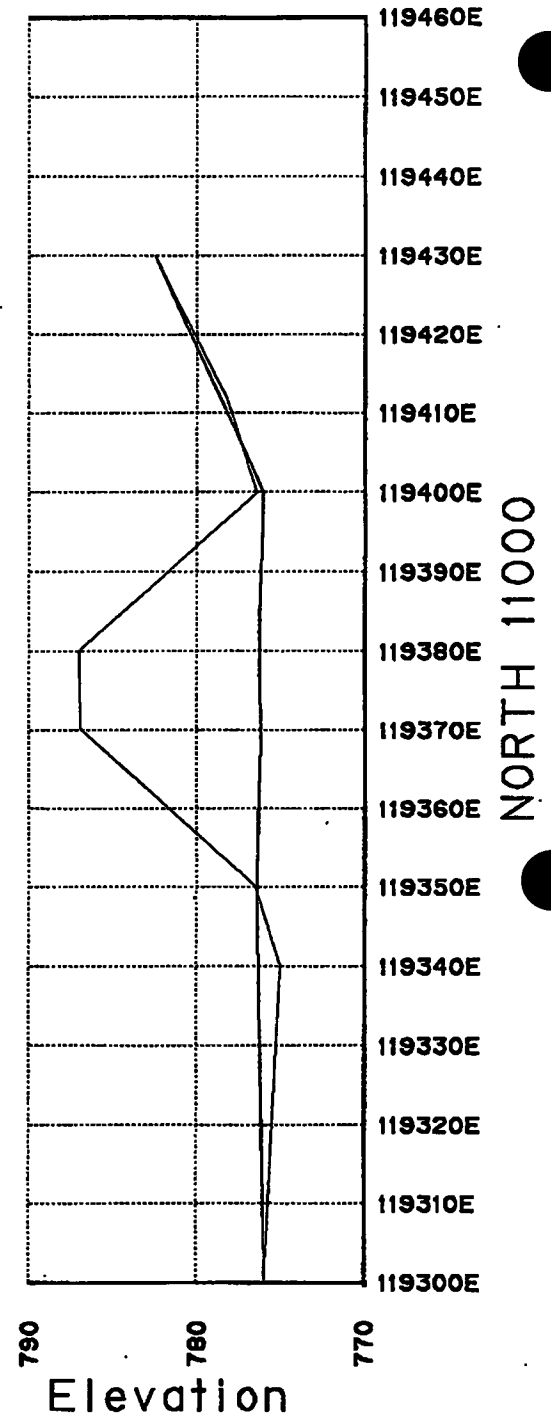
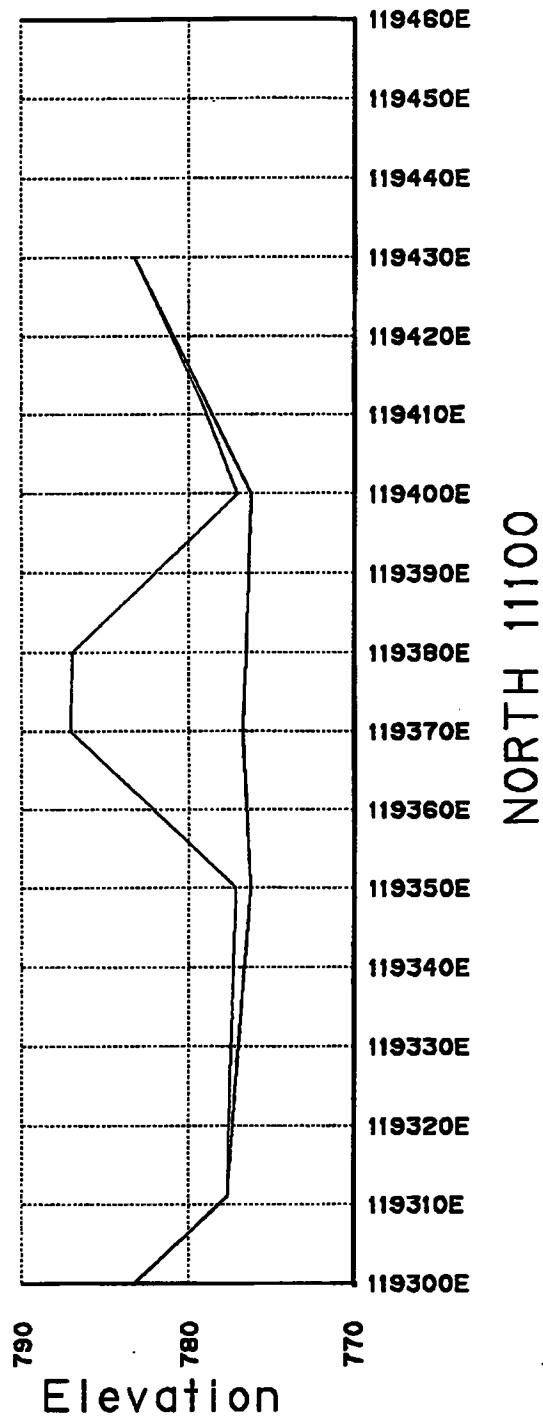
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CROSS SECTIONS
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ZION, ILLINOIS

OCTOBER, 1991

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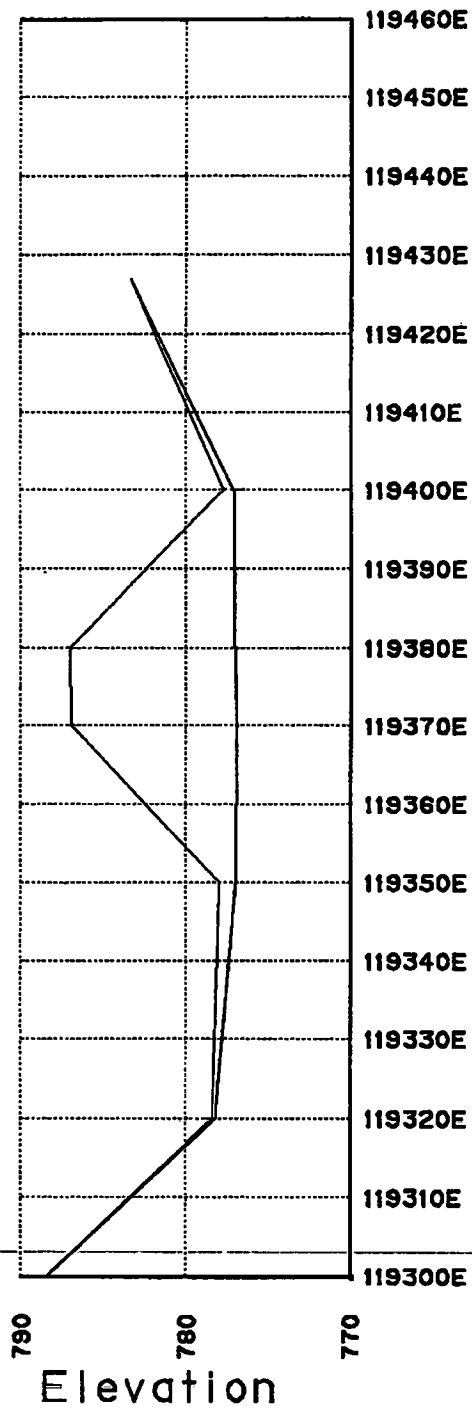


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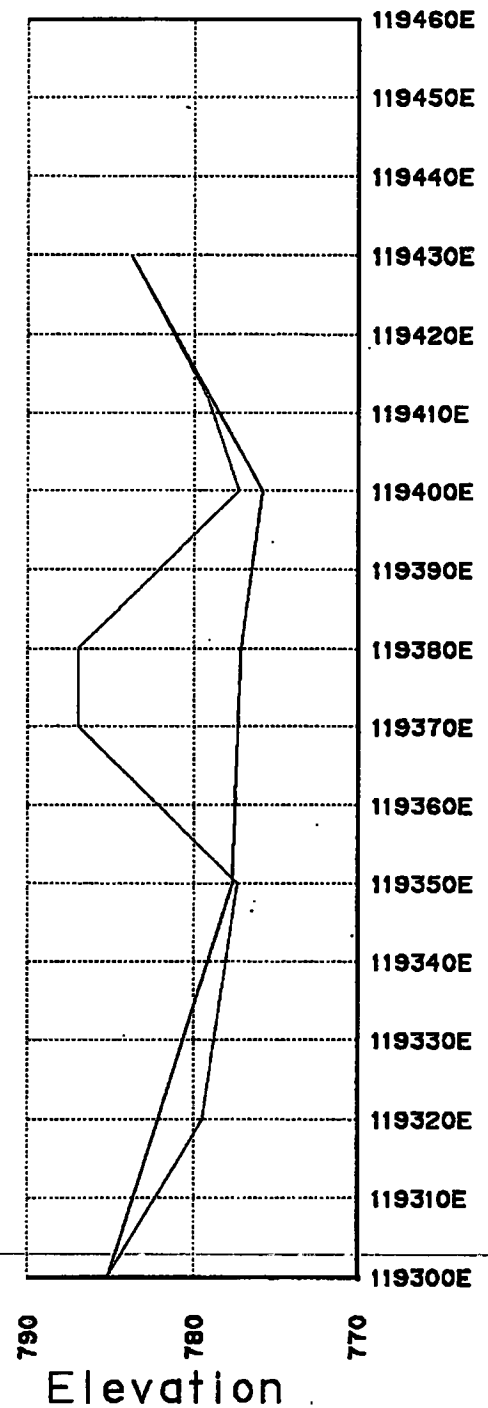
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BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

OCTOBER, 1991

Donohue ENGINEERS
 ARCHITECTS
 SCIENTISTS



NORTH 11300



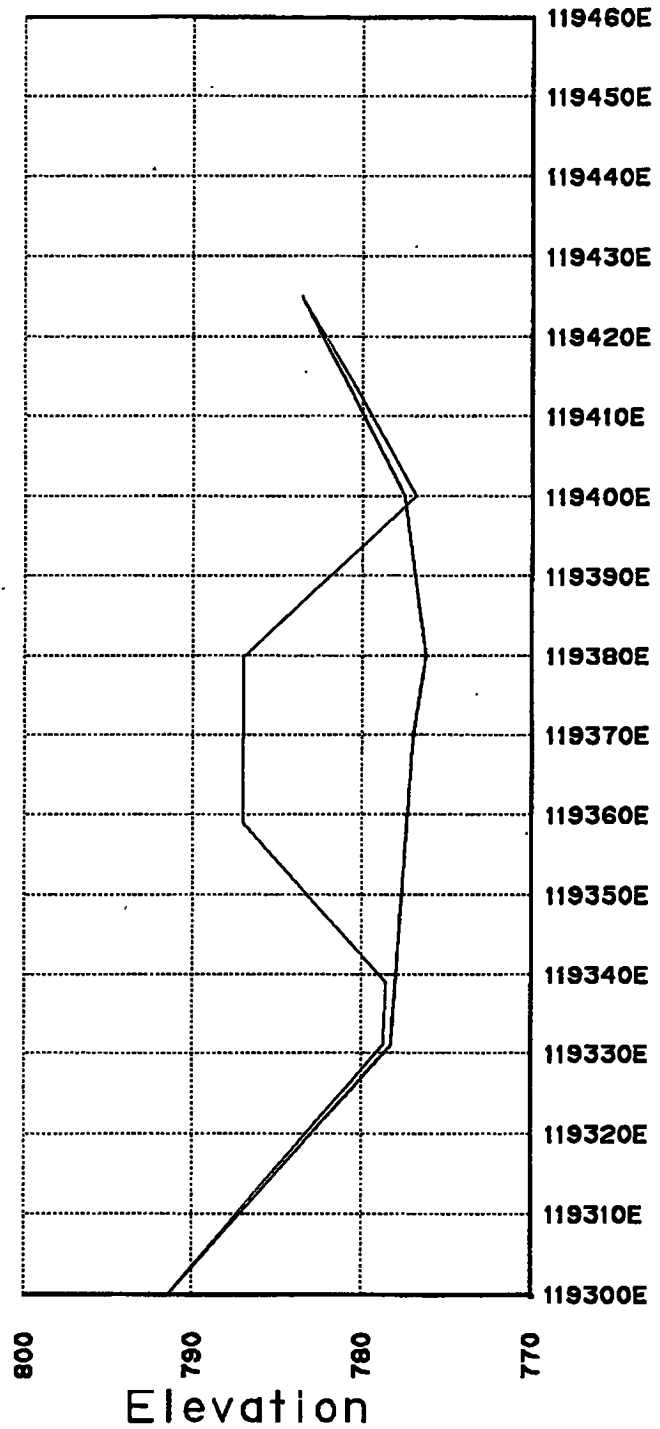
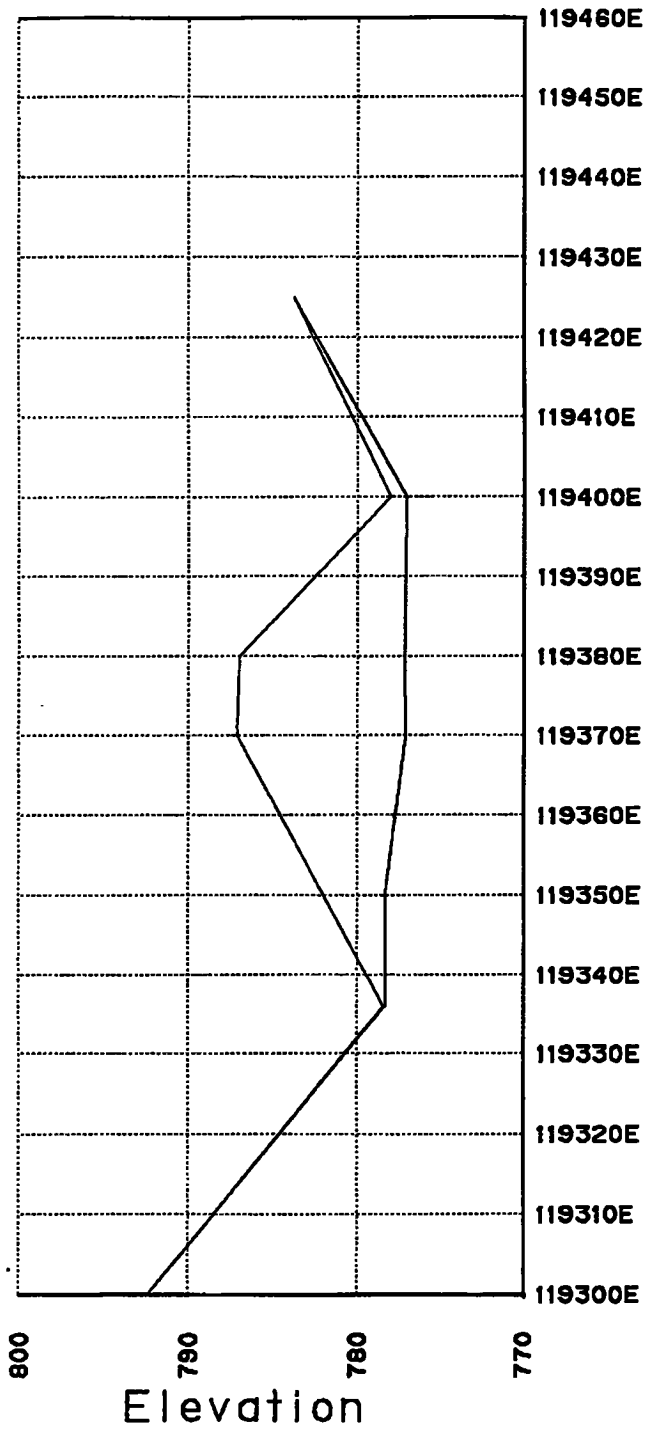
NORTH 11200

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WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

OCTOBER, 1991

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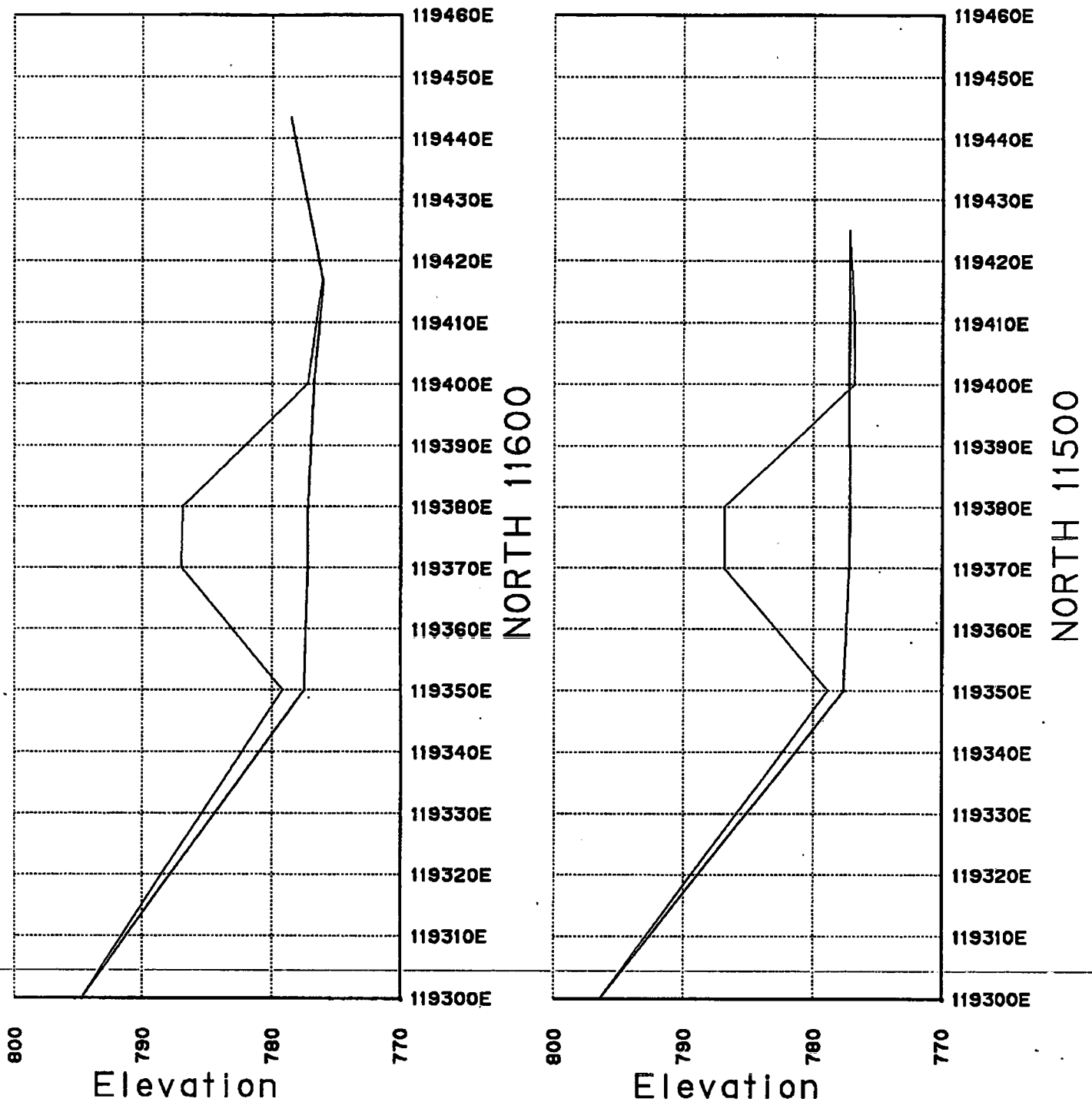


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WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

OCTOBER, 1991

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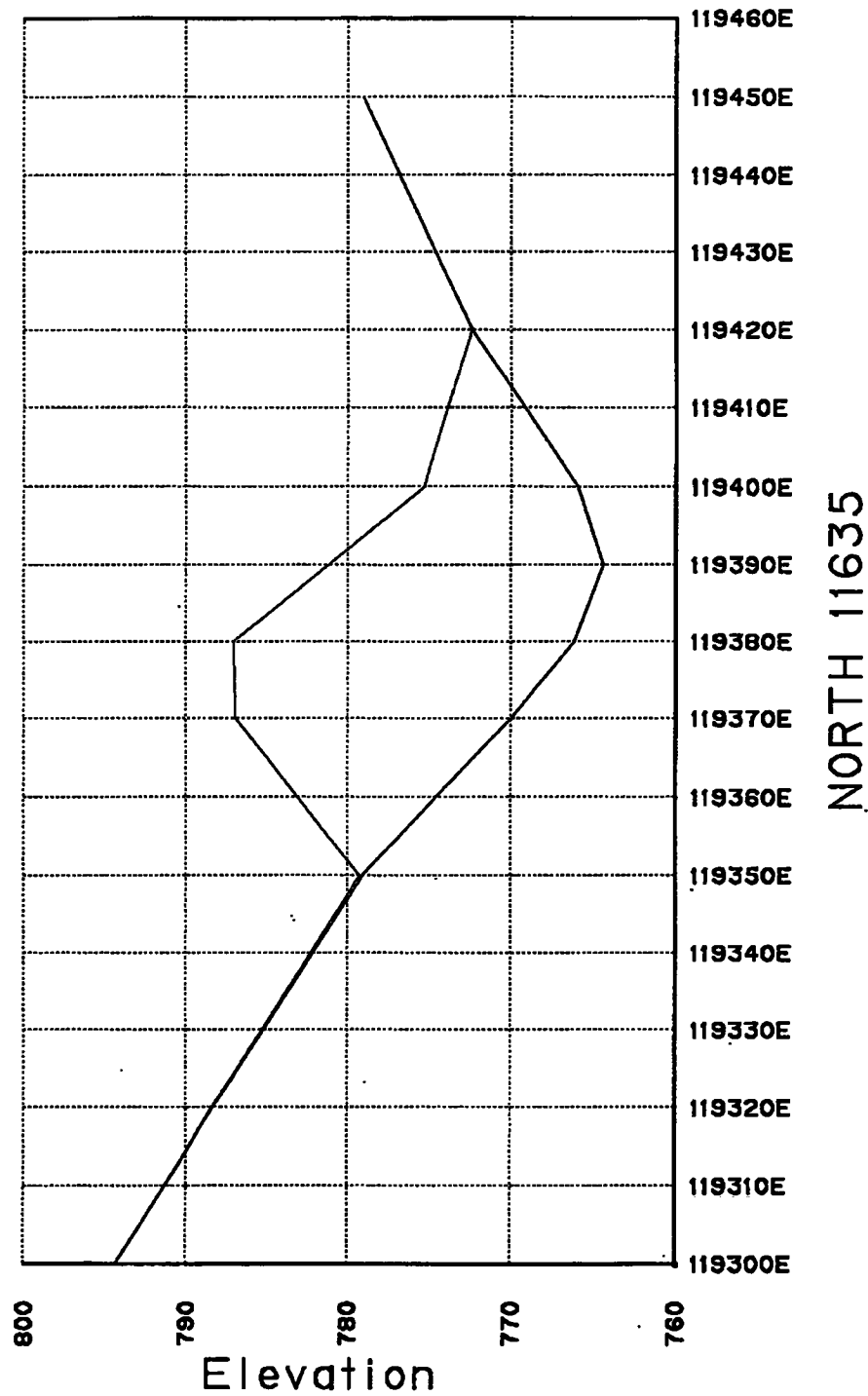


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WINTHROP HARBOR - CLAY DIVISION BERM
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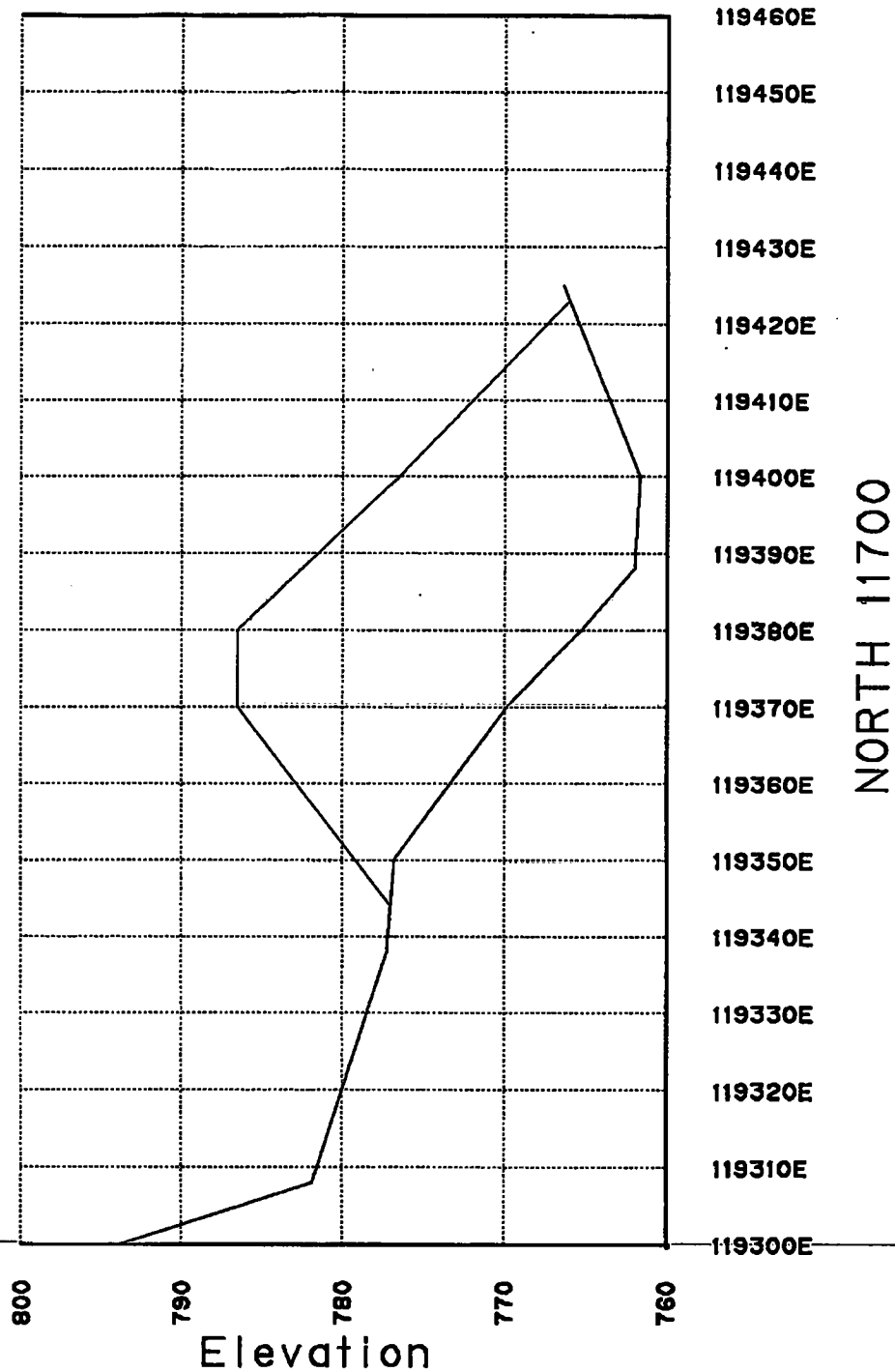


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WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

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APPENDIX E

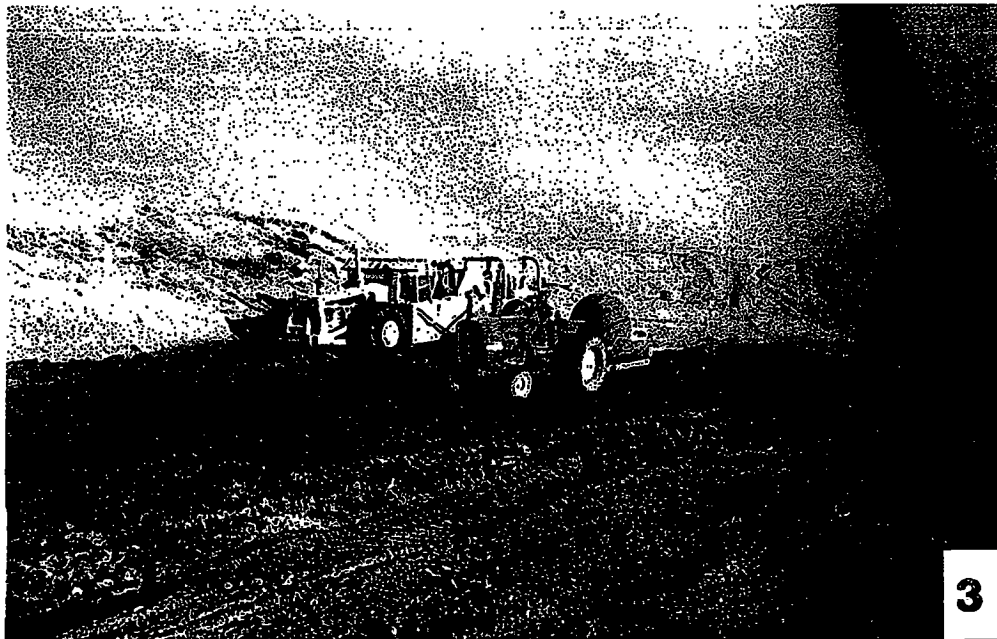
PHOTOGRAPHS

APPENDIX E

PHOTOGRAPHS

<u>Photograph No.</u>	<u>Description</u>
1	Placement and compaction of clay material at approximate station 10700 North.
2	Compaction equipment; approximate station 10800 North.
3	Adding moisture prior to placement of additional clay material; approximate station 11500 North.
4	Leveling of clay material prior to placement of additional clay material; approximate station 11600 North.
5	Rough grading crest of clay division berm; approximate station 11100 North.
6	Finish grade crest of clay division berm; approximate station 10900 North.
7	Finished clay division berm.

APPENDIX E
WINTHROP HARBOR
CLAY DIVISION BERM
CONSTRUCTION PHOTOGRAPHS



APPENDIX E
WINTHROP HARBOR
CLAY DIVISION BERM
CONSTRUCTION PHOTOGRAPHS



APPENDIX E
WINTHROP HARBOR
CLAY DIVISION BERM
CONSTRUCTION PHOTOGRAPHS



APPENDIX E
WINTHROP HARBOR
CLAY DIVISION BERM
CONSTRUCTION PHOTOGRAPHS



APPENDIX F
IN-FIELD DENSITY TEST RESULTS

FIELD DENSITY TEST REPORT
CLAY DIVISION BERM
WINTHROP HAPOR

Date	Test Number	Retest Number	Location	North	East	Elev	Soil Desc	Dry Density	Moist	Percent Moist	Wet Density	Max Density	Percent Comp
30-SEP-91	4-6		LIFT-4	11400	9375	4.00	CL	116.1	19.7	17.0	135.8	119.1	97.5
01-OCT-91	4-7		LIFT-4	11600	9380	4.00	CL	116.0	19.7	17.0	135.7	119.1	97.4
30-SEP-91	4-8		LIFT-4 *	11700	9395	4.00	CL	116.2	19.5	16.8	135.7	119.1	97.6
27-SEP-91	5-1		LIFT-5 *	10550	9380	5.00	CL	115.8	19.2	16.6	135.0	119.1	97.2
26-SEP-91	5-2		LIFT-5	10700	9380	5.00	CL	115.3	19.7	17.1	135.0	119.1	96.8
26-SEP-91	5-3		LIFT-5	10900	9380	5.00	CL	116.9	19.3	16.5	136.2	119.1	98.2
26-SEP-91	5-4		LIFT-5	11100	9375	5.00	CL	114.6	20.4	17.8	135.0	119.1	96.2
01-OCT-91	5-5	5-10	LIFT-5	11300	9375	5.00	CL	118.5	17.5	14.8	136.0	119.1	99.5
01-OCT-91	5-6	5-11	LIFT-5	11500	9375	5.00	CL	116.8	19.0	16.3	135.8	119.1	98.1
01-OCT-91	5-7		LIFT-5 *	11600	9375	5.00	CL	114.5	20.4	17.8	134.9	119.1	96.1
02-OCT-91	5-8		LIFT-5 *	11625	9380	5.00	CL	116.8	19.6	16.8	136.4	119.1	98.1
28-SEP-91	5-9		LIFT-5	11700	9390	5.00	CL	116.3	19.6	16.9	135.9	119.1	97.7
01-OCT-91	5-10	5-5	LIFT-5	11300	9375	5.00	CL	115.8	19.2	16.6	135.0	119.1	97.2
01-OCT-91	5-11	5-6	LIFT-5	11500	9375	5.00	CL	117.0	20.1	17.2	137.1	119.1	98.2
27-SEP-91	6-1		LIFT-6	10600	9380	6.00	CL	115.7	19.5	16.9	135.2	119.1	97.2
27-SEP-91	6-2	6-8	LIFT-6	10800	9380	6.00	CL	118.2	19.3	16.3	137.5	119.1	99.2
27-SEP-91	6-3		LIFT-6	11000	9380	6.00	CL	116.8	19.4	16.6	136.2	119.1	98.1
01-OCT-91	6-4		LIFT-6	11200	9375	6.00	CL	118.4	19.8	16.7	138.2	119.1	99.4
01-OCT-91	6-5		LIFT-6	11400	9375	6.00	CL	116.5	20.3	17.4	136.8	119.1	97.8
02-OCT-91	6-6		LIFT-6	11600	9375	6.00	CL	116.7	19.9	17.1	136.6	119.1	98.0
30-SEP-91	6-7		LIFT-6 *	11700	9395	6.00	CL	115.3	19.7	17.1	135.0	119.1	96.8
27-SEP-91	6-8	6-2	LIFT-6	10800	9380	6.00	CL	115.8	19.2	16.6	135.0	119.1	97.2
27-SEP-91	7-1		LIFT-7	10700	9375	7.00	CL	116.3	19.7	16.9	136.0	119.1	97.7
27-SEP-91	7-2		LIFT-7	10900	9375	7.00	CL	114.9	19.5	17.0	134.4	119.1	96.5
27-SEP-91	7-3		LIFT-7	11100	9375	7.00	CL	114.4	20.1	17.6	134.5	119.1	96.1
02-OCT-91	7-4		LIFT-7	11300	9375	7.00	CL	115.7	20.0	17.3	135.7	119.1	97.2
02-OCT-91	7-5		LIFT-7	11500	9370	7.00	CL	114.1	19.8	17.4	133.9	119.1	95.8
30-SEP-91	7-6		LIFT-7	11700	9385	7.00	CL	114.6	20.1	17.5	134.7	119.1	96.2
28-SEP-91	8-1		LIFT-8	10600	9375	8.00	CL	115.5	21.3	18.4	136.8	119.1	97.0
28-SEP-91	8-2		LIFT-8	10800	9375	8.00	CL	114.8	20.0	17.4	134.8	119.1	96.4
28-SEP-91	8-3		LIFT-8	11000	9375	8.00	CL	118.2	20.1	17.0	138.3	119.1	99.2
02-OCT-91	8-4		LIFT-8	11200	9375	8.00	CL	120.8	19.9	16.5	140.7	119.1	101.4
02-OCT-91	8-5		LIFT-8	11400	9375	8.00	CL	116.8	19.8	17.0	136.6	119.1	98.1
02-OCT-91	8-6		LIFT-8	11600	9380	8.00	CL	116.2	19.2	16.5	135.4	119.1	97.6
28-SEP-91	9-1		LIFT-9	10700	9375	9.00	CL	114.8	19.1	16.6	133.9	119.1	96.4
28-SEP-91	9-2		LIFT-9	10900	9375	9.00	CL	115.1	20.1	17.5	135.2	119.1	96.6

NOTE: "*" designates a field density test performed in addition to those on the specified grid system for the particular lift placed.

FIELD DENSITY TEST REPORT
CLAY DIVISION BERM
WINTHROP HAPOR

Date	Test Number	Retest Number	Location	North	East	Elev	Soil Desc	Dry Density	Moist	Percent Moist	Wet Density	Max Density	Percent Comp
25-SEP-91	1-1		LIFT-1	10500	9375	1.00	CL	114.7	19.8	17.3	134.5	119.1	96.3
25-SEP-91	1-2		LIFT-1 *	10550	9370	1.00	CL	115.6	19.3	16.7	134.9	119.1	97.1
24-SEP-91	1-3		LIFT-1 *	10650	9380	1.00	CL	116.3	19.4	16.7	135.7	119.1	97.7
24-SEP-91	1-4		LIFT-1	10700	9365	1.00	CL	117.2	20.0	17.1	137.2	119.1	98.4
24-SEP-91	1-5		LIFT-1 *	10850	9375	1.00	CL	115.0	20.0	17.4	135.0	119.1	96.6
24-SEP-91	1-6	1-12	LIFT-1	10900	9370	1.00	CL	116.4	17.8	15.3	134.2	119.1	97.7
24-SEP-91	1-7		LIFT-1 *	11050	9380	1.00	CL	114.9	19.5	17.0	134.4	119.1	96.5
24-SEP-91	1-8		LIFT-1	11100	9370	1.00	CL	116.3	19.4	16.7	135.7	119.1	97.7
28-SEP-91	1-9		LIFT-1	11300	9380	1.00	CL	114.8	20.0	17.4	134.8	119.1	96.4
28-SEP-91	1-10		LIFT-1	11500	9375	1.00	CL	114.8	20.1	17.5	134.9	119.1	96.4
28-SEP-91	1-11		LIFT-1	11700	9390	1.00	CL	115.1	20.1	17.5	135.2	119.1	96.6
28-SEP-91	1-12	1-6	LIFT-1	10900	9370	1.00	CL	115.0	20.0	17.4	135.0	119.1	96.6
26-SEP-91	2-1		LIFT-2 *	10550	9380	2.00	CL	115.3	19.7	17.1	135.0	119.1	96.8
25-SEP-91	2-2		LIFT-2	10600	9375	2.00	CL	113.4	20.3	17.9	133.7	119.1	95.2
25-SEP-91	2-3	2-10	LIFT-2	10800	9365	2.00	CL	114.6	17.6	15.4	132.2	119.1	96.2
25-SEP-91	2-4		LIFT-2 *	10950	9375	2.00	CL	114.8	20.1	17.5	134.9	119.1	96.4
25-SEP-91	2-5		LIFT-2	11000	9370	2.00	CL	114.7	19.8	17.3	134.5	119.1	96.3
25-SEP-91	2-6		LIFT-2 *	11150	9380	2.00	CL	115.6	19.3	16.7	134.9	119.1	97.1
28-SEP-91	2-7		LIFT-2	11200	9375	2.00	CL	116.3	19.4	16.7	135.7	119.1	97.7
28-SEP-91	2-8		LIFT-2	11400	9375	2.00	CL	114.8	19.1	16.6	133.9	119.1	96.4
28-SEP-91	2-9		LIFT-2	11600	9375	2.00	CL	115.1	20.1	17.5	135.2	119.1	96.6
25-SEP-91	2-10	2-3	LIFT-2	10800	9375	2.00	CL	114.0	20.4	17.9	134.4	119.1	95.7
26-SEP-91	3-1		LIFT-3	10500	9375	3.00	CL	115.8	19.7	17.0	135.5	119.1	97.2
26-SEP-91	3-2		LIFT-3 *	10550	9380	3.00	CL	115.1	20.1	17.5	135.2	119.1	96.6
26-SEP-91	3-3	3-8	LIFT-3	10700	9375	3.00	CL	118.2	19.0	16.1	137.2	119.1	99.2
25-SEP-91	3-4		LIFT-3	10900	9375	3.00	CL	114.8	20.1	17.5	134.9	119.1	96.4
25-SEP-91	3-5		LIFT-3	11100	9365	3.00	CL	115.9	19.2	16.6	135.1	119.1	97.3
30-SEP-91	3-6		LIFT-3	11300	9375	3.00	CL	114.6	19.6	17.1	134.2	119.1	96.2
30-SEP-91	3-7		LIFT-3	11500	9365	3.00	CL	116.3	19.6	16.9	135.9	119.1	97.7
26-SEP-91	3-8	3-3	LIFT-3	10700	9375	3.00	CL	115.1	20.1	17.5	135.2	119.1	96.6
28-SEP-91	3-9		LIFT-3	11700	9385	3.00	CL	114.8	19.1	16.6	133.9	119.1	96.4
26-SEP-91	4-1		LIFT-4 *	10550	9380	4.00	CL	115.0	19.8	17.2	134.8	119.1	96.6
26-SEP-91	4-2		LIFT-4	10600	9370	4.00	CL	115.3	19.7	17.1	135.0	119.1	96.8
26-SEP-91	4-3		LIFT-4	10800	9375	4.00	CL	115.8	19.7	17.0	135.5	119.1	97.2
26-SEP-91	4-4		LIFT-4	11000	9375	4.00	CL	115.0	19.8	17.2	134.8	119.1	96.6
30-SEP-91	4-5		LIFT-4	11200	9375	4.00	CL	115.4	20.1	17.4	135.5	119.1	96.9

NOTE: "*" designates a field density test performed in addition to those on the specified grid system for the particular lift placed.

FIELD DENSITY TEST REPORT
CLAY DIVISION BERM
WINTHROP HAPOR

Date	Test Number	Retest Number	Location	North	East	Elev	Soil Desc	Dry Density	Moist	Percent Moist	Wet Density	Max Density	Percent Comp
28-SEP-91	9-3		LIFT-9	11100	9375	9.00	CL	114.8	20.0	17.4	134.8	119.1	96.4
03-OCT-91	9-4		LIFT-9	11300	9375	9.00	CL	115.3	19.4	16.8	134.7	119.1	96.8
03-OCT-91	9-5		LIFT-9	11500	9375	9.00	CL	114.2	20.5	18.0	134.7	119.1	95.9
30-SEP-91	9-6		LIFT-9	11700	9390	9.00	CL	116.2	19.5	16.8	135.7	119.1	97.6
03-OCT-91	10-1		LIFT-10	10600	9370	10.00	CL	117.8	20.2	17.1	138.0	119.1	98.9
30-SEP-91	10-2		LIFT-10 *	11750	9390	10.00	CL	116.7	19.7	16.9	136.4	119.1	98.0
03-OCT-91	10-3		LIFT-10	10800	9375	10.00	CL	117.1	20.0	17.1	137.1	119.1	98.3
03-OCT-91	10-4		LIFT-10	11000	9375	10.00	CL	117.7	20.2	17.2	137.9	121.2	97.1
03-OCT-91	10-5		LIFT-10	11200	9375	10.00	CL	117.7	20.0	17.0	137.7	121.2	97.1
03-OCT-91	10-6		LIFT-10	11400	9375	10.00	CL	115.9	18.9	16.3	134.8	121.2	95.6
03-OCT-91	10-7		LIFT-10	11600	9375	10.00	CL	115.5	19.3	16.7	134.8	121.2	95.3
01-OCT-91	11-1		LIFT-11 *	11700	9380	11.00	CL	115.4	21.1	18.3	136.5	119.1	96.9
01-OCT-91	12-1		LIFT-12 *	11750	9385	12.00	CL	115.1	20.2	17.5	135.3	119.1	96.6
01-OCT-91	13-1		LIFT-13 *	11700	9375	13.00	CL	116.6	19.8	17.0	136.4	119.1	97.9
02-OCT-91	15-1		LIFT-15 *	11700	9395	15.00	CL	117.1	20.5	17.5	137.6	119.1	98.3
02-OCT-91	17-1		LIFT-17 *	11700	9380	17.00	CL	115.4	20.3	17.6	135.7	119.1	96.9
03-OCT-91	19-1		LIFT-19 *	11700	9380	19.00	CL	116.8	19.6	16.8	136.4	119.1	98.1
03-OCT-91	21-1		LIFT-21 *	11700	9385	21.00	CL	116.6	19.8	17.0	136.4	119.1	97.9
03-OCT-91	23-1		LIFT-23 *	11700	9385	23.00	CL	114.8	20.1	17.5	134.9	119.1	96.4
03-OCT-91	25-1		LIFT-25 *	11700	9375	25.00	CL	116.3	19.4	16.7	135.7	119.1	97.7

NOTE: "*" designates a field density test performed in addition to those on the specified grid system for the particular lift placed.

APPENDIX G

LABORATORY SOIL TEST RESULTS



MILWAUKEE, WI
LOS ANGELES, CA

GILES ENGINEERING ASSOCIATES, INC.
GEOTECHNICAL GEO-ENVIRONMENTAL GEO-HYDROLOGICAL
AND CONSTRUCTION MATERIALS CONSULTANTS

☐ N8 W22350 JOHNSON ROAD/WAUKESHA, WI 53186/414-544-0118/FAX: 414-549-5868
☐ 4879 EAST LA PALMA AVENUE SUITE 201/ANAHEIM, CA 92807/714-779-0052/FAX: 714-779-0068

REPORT OF LABORATORY TESTING

Client: Donohue & Associates, Inc. **Project:** Winthrop Harbor Landfill
 4738 N. 40th Street Waukegan, Illinois
 Sheboygan, WI 53053

Date: October 11, 1991 **Project No.:** I-910919
 =====

In accordance with your request, laboratory testing was performed on the following samples for Winthrop Harbor Landfill. Laboratory testing was performed in general accordance with ASTM Test Procedures (D422, D4318, D698, D2434, D2216, D2488).

<u>Sample No.</u>	<u>Sample Description/ Location</u>	<u>Test</u>	<u>Results</u>
1R	Gray Silty Clay Clay Bulk Sample Borrow Area	Standard Proctor Maximum Dry Density Optimum Moisture	119.1 pcf 13.5 percent
2R	Gray Silty Clay Clay Bulk Sample Borrow Area	Standard Proctor Maximum Dry Density Optimum Moisture Atterberg Limits Grainsize Analysis Clay Content Percent Passing #200 Moisture Content	120.4 pcf 12.6 percent LL=26, PL=13 30.1 percent 85.3 percent 15.4 percent
1U	Gray Silty Clay Borrow Area	Atterberg Limits Grainsize Analysis Clay Content Percent Passing #200 Moisture Content Dry Density Hydraulic Conduct.	LL=26, PL=13 32.8 percent 86.1 percent 15.2 percent 123.0 pcf 1x10 ⁻⁸ cm/sec
2U	Gray Silty Clay Borrow Area	Hydraulic Conduct.	8x10 ⁻⁹ cm/sec

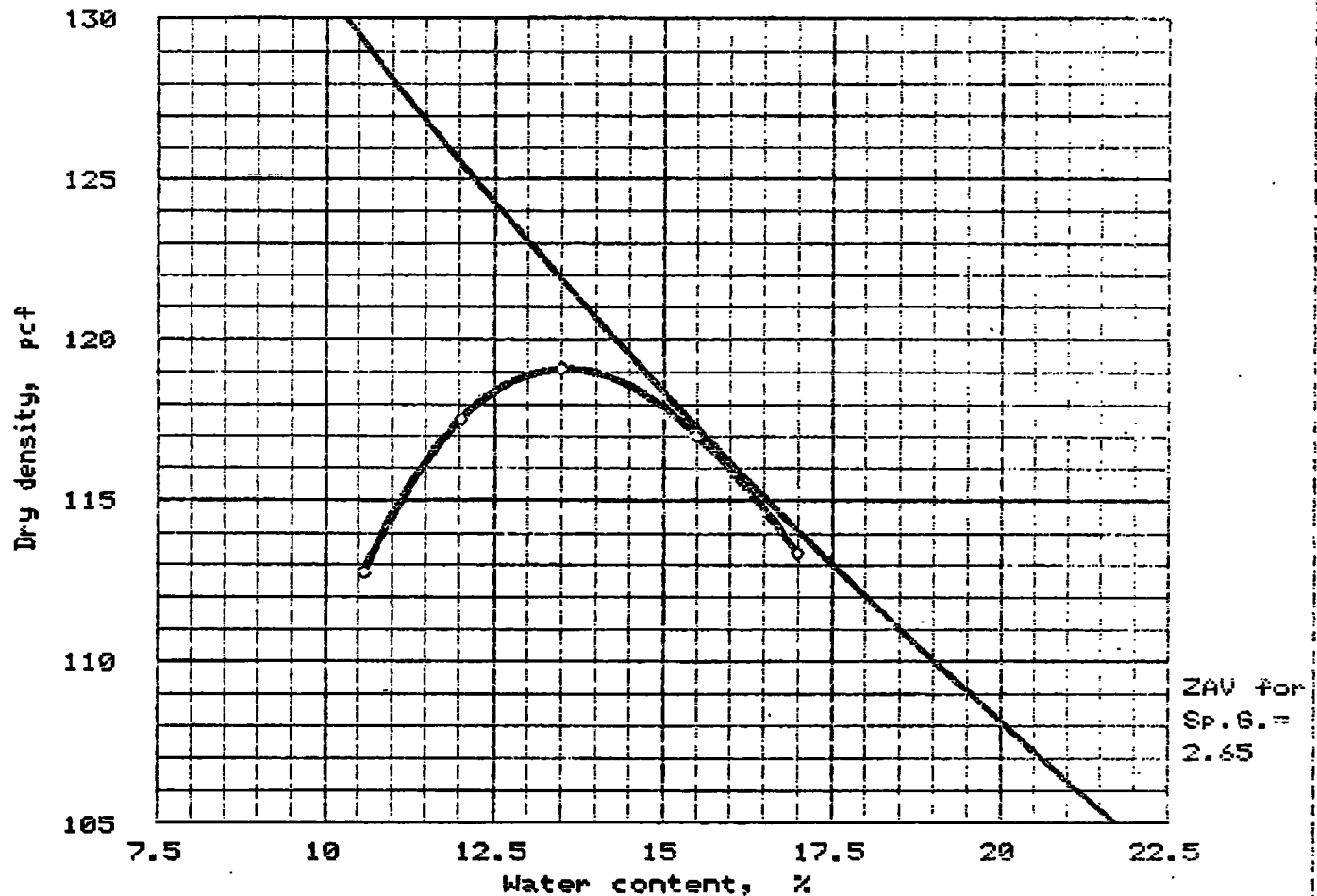
Winthrop Harbor Landfill
 Waukegan, Illinois
 GEA Project No. I-910919
 October 11, 1991
 Page 2

<u>Sample No.</u>	<u>Sample Description/ Location</u>	<u>Test</u>	<u>Results</u>
3R	Gray Silty Clay Clay Bulk Sample Borrow Area	Standard Proctor Maximum Dry Density Optimum Moisture Atterberg Limits Grainsize Analysis Clay Content Percent Passing #200 Moisture Content	121.2 pcf 12.6 percent LL=26, PL=13 30.3 percent 85.5 percent 16.0 percent
3U	Gray Silty Clay with Sand Borrow Area	Atterberg Limits Grainsize Analysis Clay Content Percent Passing #200 Moisture Content Dry Density Hydraulic Conduct.	LL=25, PL=14 27.7 percent 79.3 percent 14.4 percent 125.1 pcf 8x10 ⁻⁹ cm/sec
4R	Gray Silty Clay Clay Bulk Sample Borrow Area	Standard Proctor Maximum Dry Density Optimum Moisture Atterberg Limits Grainsize Analysis Clay Content Percent Passing #200 Moisture Content	121.9 pcf 12.4 percent LL=26, PL=13 30.7 percent 85.3 percent 15.2 percent

REVIEWED BY: Don Mich

Oct91/2/pjs/Bu98

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 119.1 pcf

Optimum moisture = 13.5 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
1R			14.2 %	2.65				

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Clay Bulk Sample
Borrow Area-Sample 1R

Project No.: I-910919

Project: Winthrop Harbor

Client: Donohue and Associates, Inc.

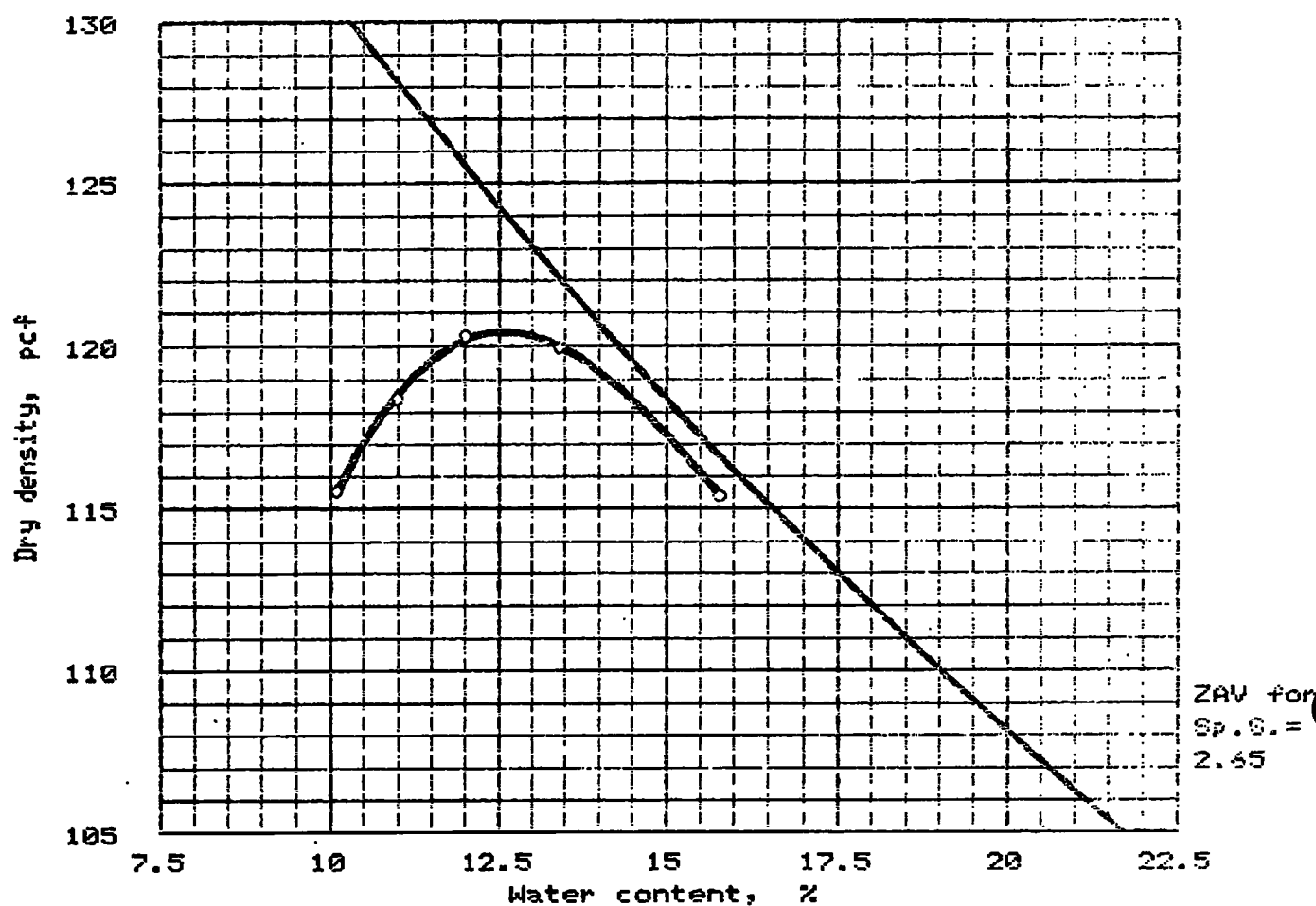
Date: 9-23-1991

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 120.4 pcf

Optimum moisture = 12.6 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
2R	CL	A-6(8.6)	15.4 %	2.65	26	13	0.0 %	85.3 %

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Clay Bulk Sample
Borrow Area-Sample 2R

Project No.: I-910919

Project: Winthrop Harbor

Client: Donohue and Associates, Inc.

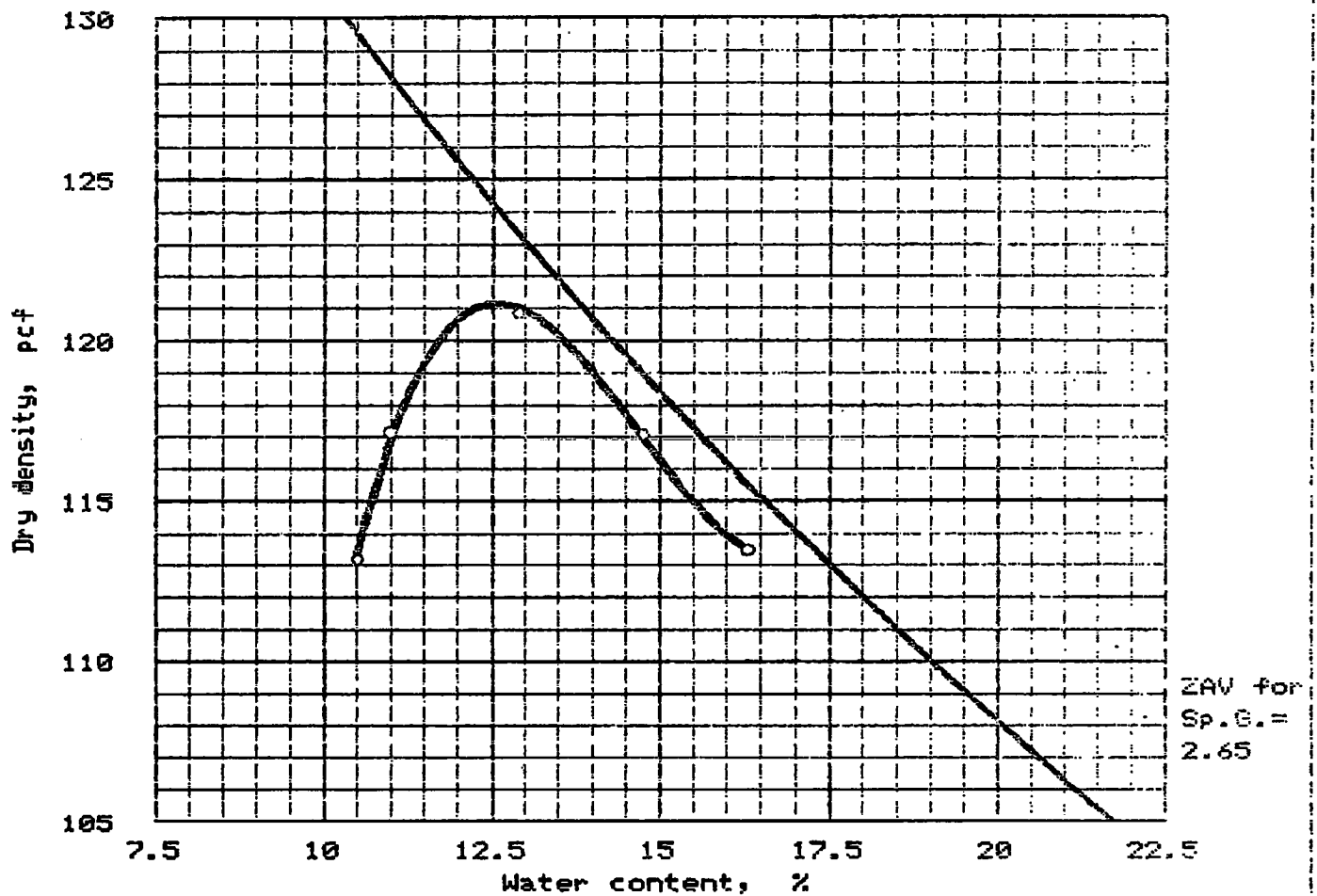
Date: 10-3-1991

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 121.2 pcf

Optimum moisture = 12.6 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
3R	CL	A-6(9.6)	16.0 %	2.65	27	14	1.7 %	85.5 %

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Clay Bulk Sample
Borrow Area-Sample 3R

Project No.: I-910919

Project: Winthrop Harbor

Client: Donohue and Associates, Inc.

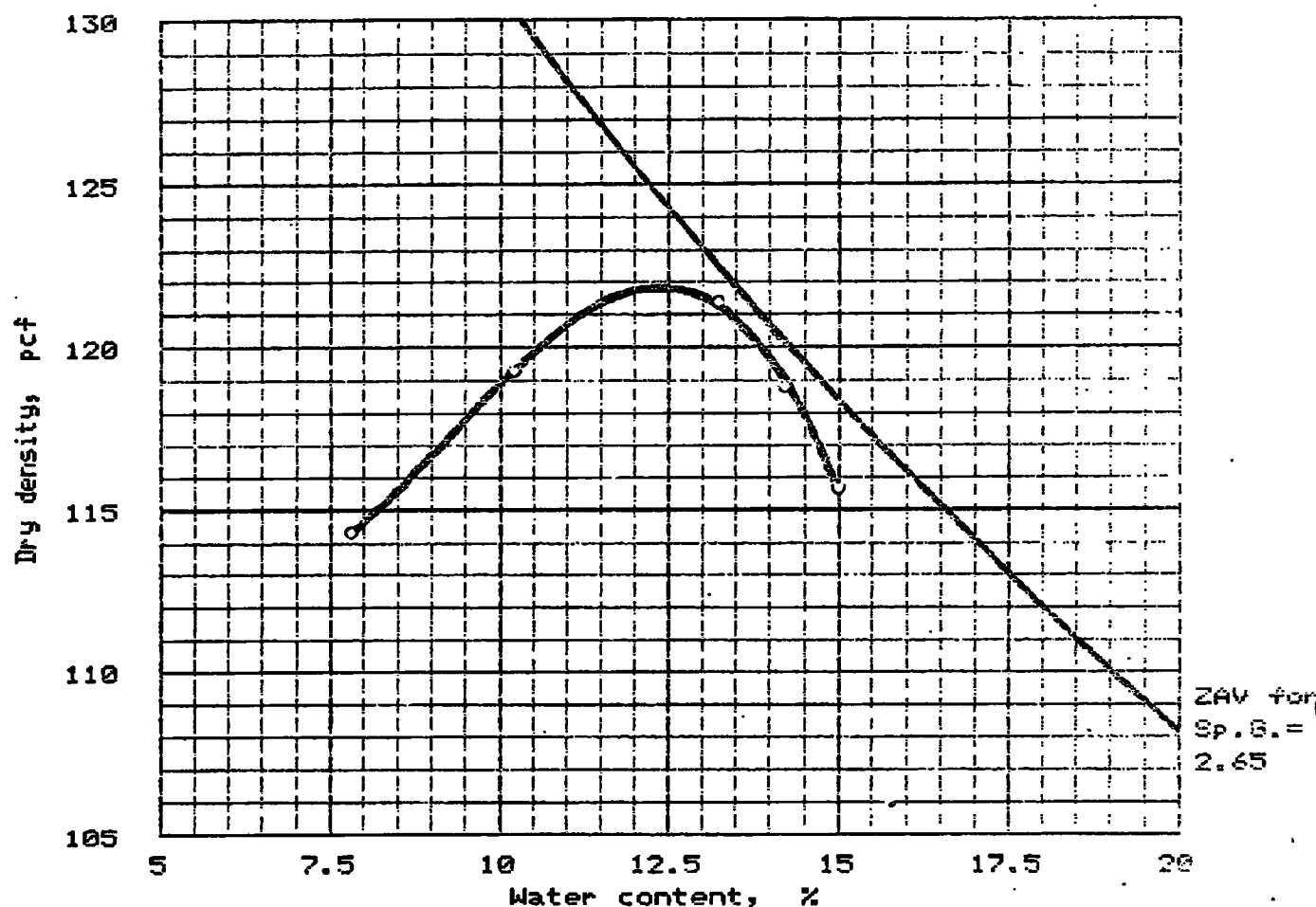
Date: 10-3-1991

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 121.9 pcf

Optimum moisture = 12.4 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
4R	CL	A-6(8.6)	15.2 %	2.65	26	14	0.0 %	85.3 %

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Clay Bulk Sample
Borrow Area-Sample 4R

Project No.: I-910919

Project: Winthrop Harbor

Client: Donohue and Associates, Inc.

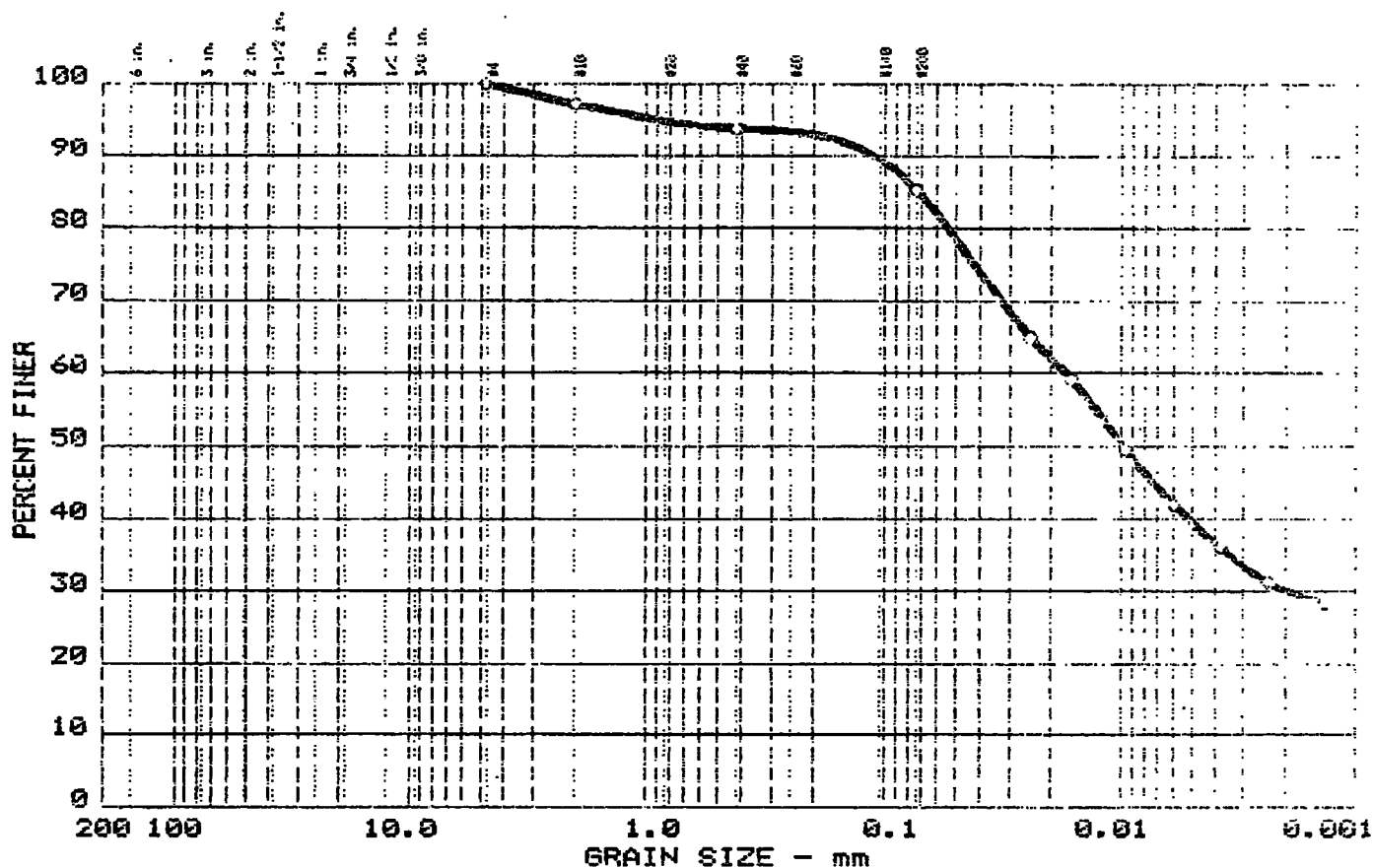
Date: 10-10-1991

Giles Engineering Assoc., Inc.

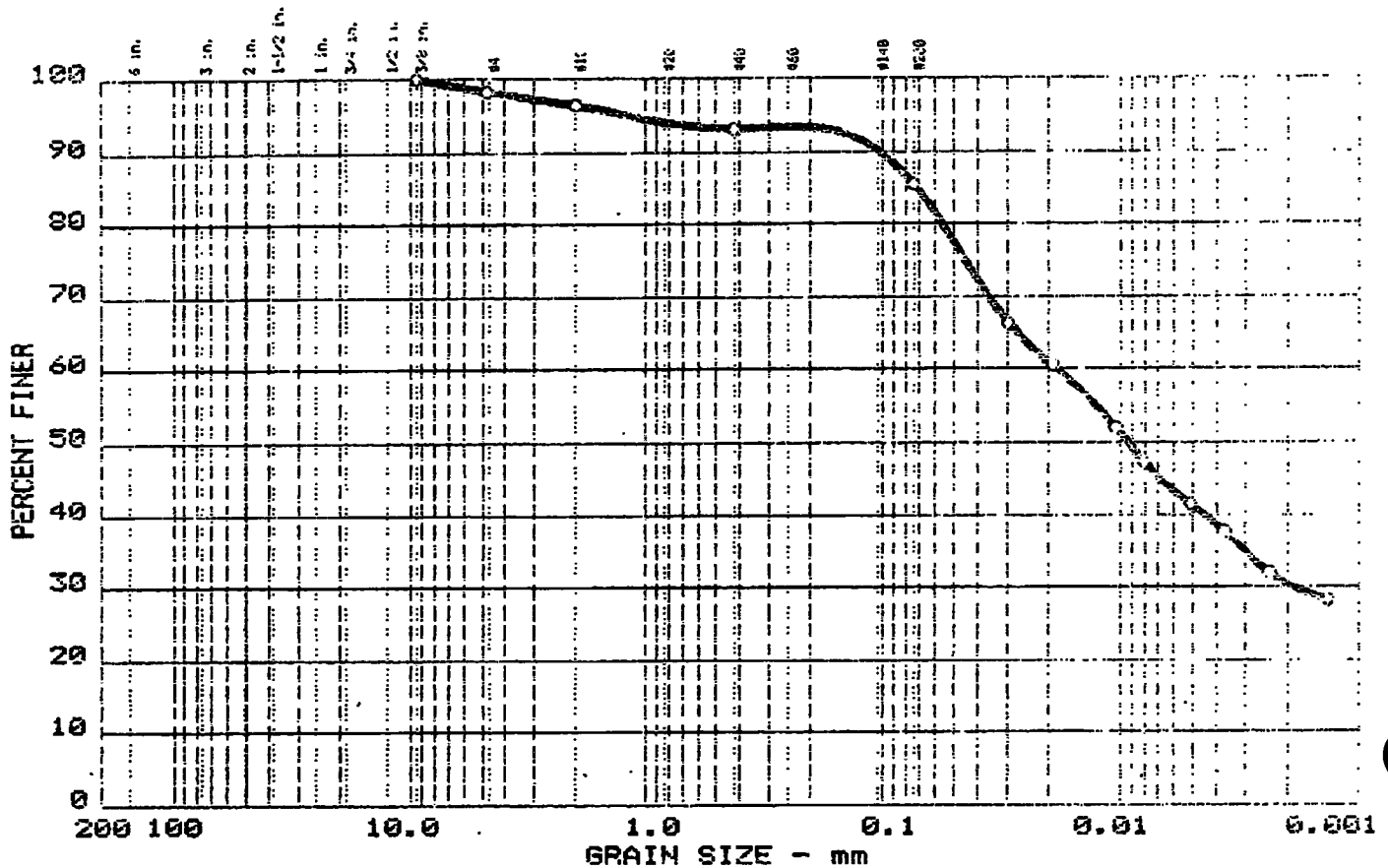
Remarks:

Figure No. _____

GRAIN SIZE DISTRIBUTION TEST REPORT



GRAIN SIZE DISTRIBUTION TEST REPORT



	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
0	0.0	1.7	12.8	55.2	30.3	CL	A-6(9.6)

[illegible]

MATERIAL DESCRIPTION	SAMPLE LOCATION
o Gray Silty Clay	o Borrow Area-Sample 3R

Project No.: I-910919
Project: Winthrop Harbor
Client: Donohue and Associates, Inc.

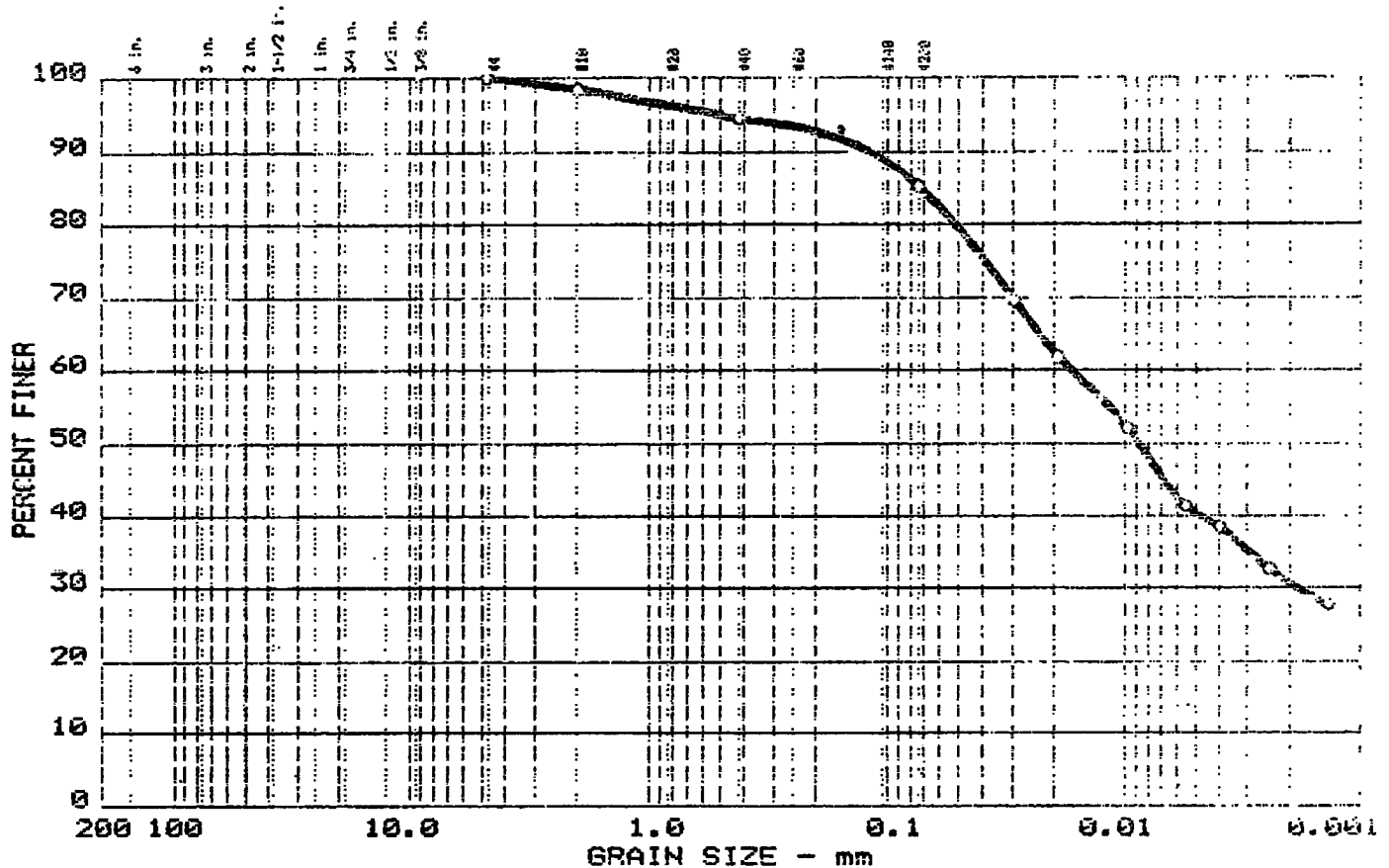
Date: 10-10-1991

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

GRAIN SIZE DISTRIBUTION TEST REPORT



%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	ASTM
0.0	0.0	14.7	54.6	30.7	CL	A-6(8.6)

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
15.2	26	13	13.0	2.7		0.002			

MATERIAL DESCRIPTION	SAMPLE LOCATION
Gray Silty Clay	Borrow Area-Sample 4R

Project No.: I-910919
 Project: Winthrop Harbor
 Client: Donohue and Associates, Inc.

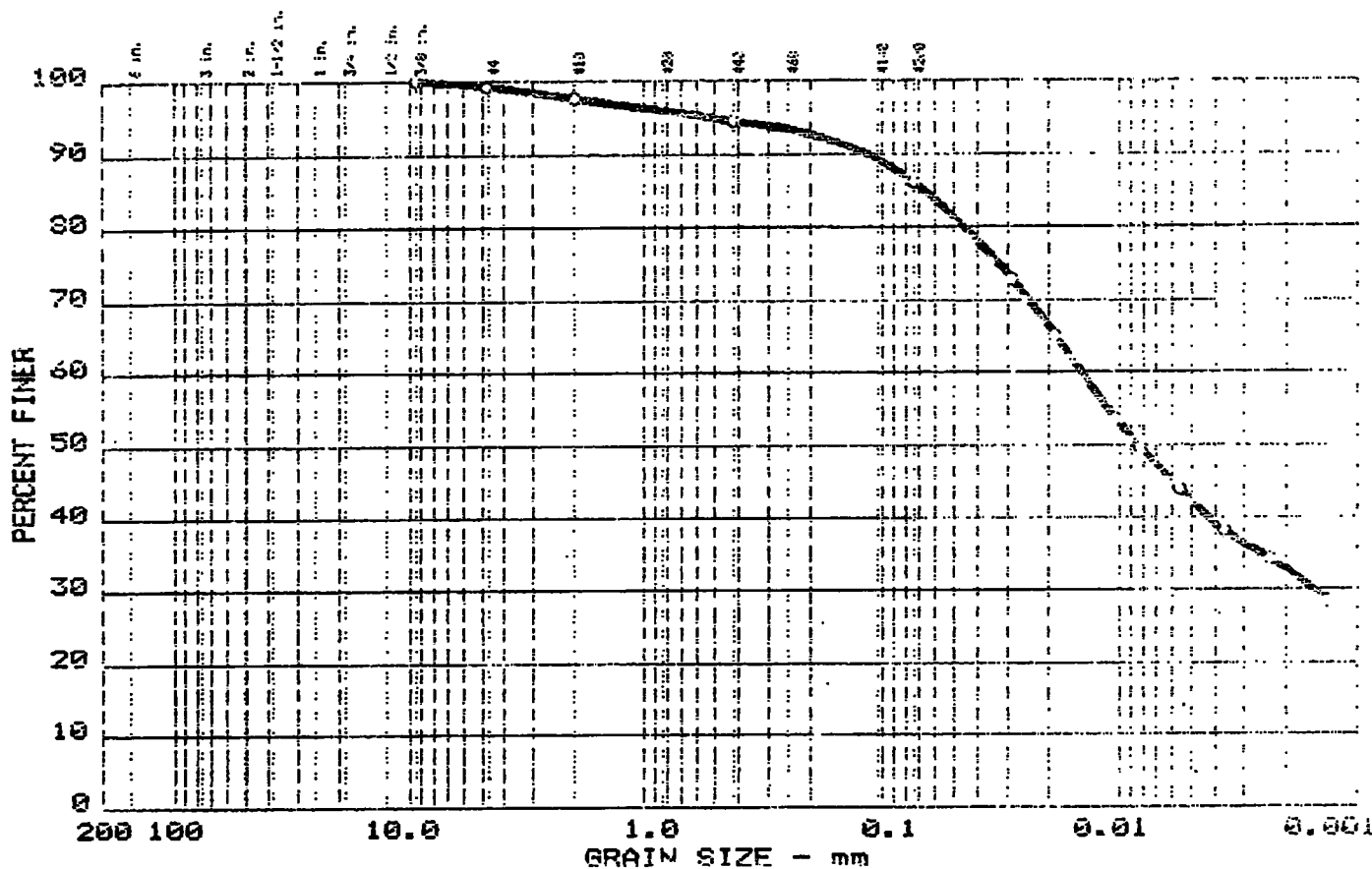
Date: 10-10-1991

Giles Engineering Assoc., Inc.

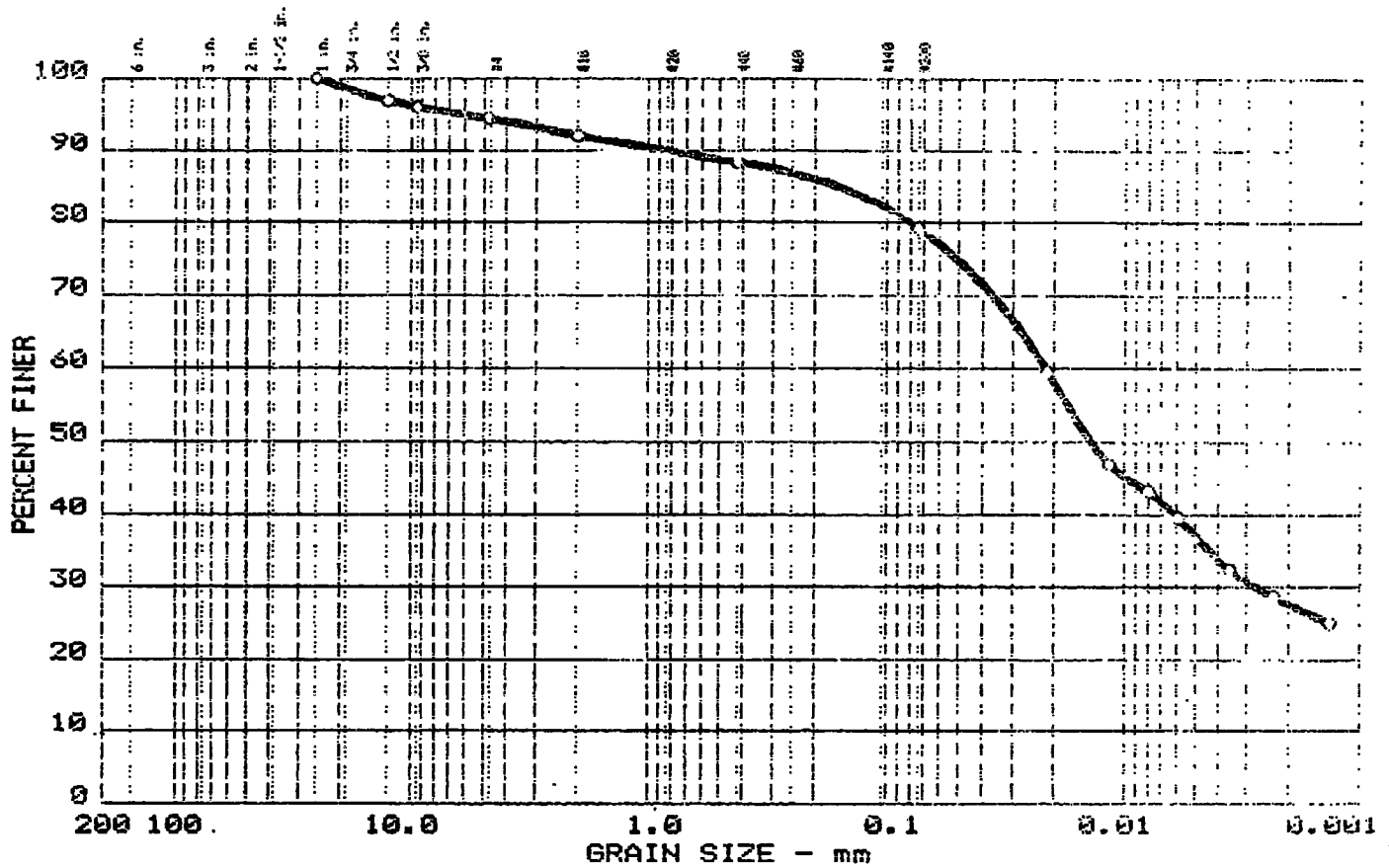
Remarks:

Figure No. _____

GRAIN SIZE DISTRIBUTION TEST REPORT



GRAIN SIZE DISTRIBUTION TEST REPORT



%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
0.0	5.6	15.1	51.6	27.7	CL	A-6(6.1)

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
14.4	25	14	11.0	2.7		0.003			

MATERIAL DESCRIPTION	SAMPLE LOCATION
Gray Silty Clay with Sand	Borrow Area-Sample 3U

Project No.: I-910919
 Project: Winthrop Harbor
 Client: Donohue and Associates, Inc.

Date: 10-10-1991

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____



MILWAUKEE, WI
LOS ANGELES, CA

GILES ENGINEERING ASSOCIATES, INC.

GEOTECHNICAL, GEO-ENVIRONMENTAL, GEO-HYDROLOGICAL
AND CONSTRUCTION MATERIALS CONSULTANTS

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☐ 4879 EAST LA PALMA AVENUE SUITE 201/ANAHEIM, CA 92807/714-779-0052/FAX: 714-779-0068

REPORT OF RIGID WALL PERMEABILITY TEST (FALLING HEAD METHOD)

CLIENT: Donohue & Associates
4738 N. 40th Street
Sheboygan, WI 53053

PROJECT: Winthrop Harbor Landfill
Waukegan, Illinois

DATE: October 11, 1991

PROJECT NO.: I-910919

SAMPLE DESCRIPTION: Gray Silty Clay
SAMPLE LOCATION: Borrow Area - Sample 1U

SOIL SAMPLE CHARACTERISTICS

SOIL CLASSIFICATION:	CL		
NATURAL MOISTURE:	-	PERCENT FINER NO.200:	86.1
LIQUID LIMIT:	26	MAX. DRY DENSITY, pcf:	-
PLASTIC LIMIT:	13	OPTIMUM MOISTURE, %:	-

SAMPLE PREPARATION

SAMPLE HEIGHT (L), cm:	2.67	CELL NUMBER:	3
BURETTE AREA (a), sq. cm:	0.94	PERMEANT FLUID:	Distilled Water
SAMPLE AREA (A), sq cm:	18.87	ONE PORE VOLUME, cm:	14.7
SAMPLE MOISTURE, %:	15.2	SAMPLE DRY DENSITY, pcf:	119.8

TEST DATA

CLOCK TIME		TIME t (sec)	BURETTE READING; HEAD (cm)		PERMEABILITY (cm/sec) = $2.3(aL/At) * \log_{10}(H_0/H)$
10-4	10-11		INITIAL (H ₀)	FINAL (H)	
7:35	8:50	256,500	296.51	286.01	1.9×10^{-8} 1 Pore Volume
8:52	8:40	85,680	298.15	295.67	1.3×10^{-8}
8:40	8:35	86,100	295.67	293.28	1.3×10^{-8}
8:35	8:55	87,600	293.28	290.93	1.2×10^{-8}
8:55	8:35	85,200	290.93	288.62	1.2×10^{-8}
AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 1 \times 10^{-8}$ cm/sec					

REMARKS:

REVIEWED BY: DON MICH



MILWAUKEE, WI
LOS ANGELES, CA

GILES ENGINEERING ASSOCIATES, INC.

GEOTECHNICAL GEO-ENVIRONMENTAL GEO-HYDROLOGICAL
AND CONSTRUCTION MATERIALS CONSULTANTS

☐ N8 W22350 JOHNSON ROAD/WAUWATOSA, WI 53186/414-544-0118/FAX: 414-549-5868
☐ 4879 EAST LA PALMA AVENUE SUITE 201/ANAHEIM, CA 92807/714-779-0052/FAX: 714-779-0068

REPORT OF RIGID WALL PERMEABILITY TEST (FALLING HEAD METHOD)

CLIENT: Donohue & Associates
4738 N. 40th Street
Sheboygan, WI 53053

PROJECT: Winthrop Harbor Landfill
Waukegan, Illinois

DATE: October 11, 1991

PROJECT NO.: I-910919

SAMPLE DESCRIPTION: Gray Silty Clay
SAMPLE LOCATION: Borrow Area - Sample 2U

SOIL SAMPLE CHARACTERISTICS

SOIL CLASSIFICATION: CL
NATURAL MOISTURE: - PERCENT FINER NO. 200: -
LIQUID LIMIT: - MAX. DRY DENSITY, pcf: -
PLASTIC LIMIT: - OPTIMUM MOISTURE, %: -

SAMPLE PREPARATION

SAMPLE HEIGHT (L), cm: 2.62 CELL NUMBER: 2
BURETTE AREA (a), sq. cm: 0.94 PERMEANT FLUID: Distilled Water
SAMPLE AREA (A), sq cm: 18.87 ONE PORE VOLUME, cm: 13.6
SAMPLE MOISTURE, %: 15.7 SAMPLE DRY DENSITY, pcf: 122.2

TEST DATA

CLOCK TIME 10-0, 10-11		TIME t (sec)	BURETTE READING; HEAD (cm) INITIAL (H ₀) FINAL (H)		PERMEABILITY (cm/sec) = $2.3(aL/At) * \log_{10}(H_0/H)$
7:35	8:50	256,500	295.84	286.94	1.6×10^{-8} 1 Pore Volume
8:52	8:40	85,680	298.74	297.10	8.4×10^{-9}
9:40	9:35	86,100	297.10	295.51	8.1×10^{-9}
8:35	8:55	87,600	295.51	293.99	7.7×10^{-9}
8:55	8:35	85,200	293.99	292.57	7.4×10^{-9}
AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 8 \times 10^{-9}$ cm/sec					

REMARKS:

REVIEWED BY: DON MICH



MILWAUKEE, WI
LOS ANGELES, CA

GILES ENGINEERING ASSOCIATES, INC.

GEOTECHNICAL GEO-ENVIRONMENTAL GEO-HYDROLOGICAL
AND CONSTRUCTION MATERIALS CONSULTANTS

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REPORT OF RIGID WALL PERMEABILITY TEST (FALLING HEAD METHOD)

CLIENT: Donohue & Associates
4738 N. 40th Street
Sheboygan, WI 53053

PROJECT: Winthrop Harbor Landfill
Waukegan, Illinois

DATE: October 11, 1991

PROJECT NO.: I-910919

SAMPLE DESCRIPTION: Gray Silty Clay
SAMPLE LOCATION: Borrow Area - Sample 3U

SOIL SAMPLE CHARACTERISTICS

SOIL CLASSIFICATION:	CL		
NATURAL MOISTURE:	-	PERCENT FINER NO.200:	79.3
LIQUID LIMIT:	25	MAX. DRY DENSITY, pcf:	-
PLASTIC LIMIT:	14	OPTIMUM MOISTURE, %:	-

SAMPLE PREPARATION

SAMPLE HEIGHT (L), cm:	2.79	CELL NUMBER:	2
BURETTE AREA (a), sq. cm:	0.94	PERMEANT FLUID:	Distilled Water
SAMPLE AREA (A), sq cm:	18.87	ONE PORE VOLUME, cm:	15.4
SAMPLE MOISTURE, %:	14.4	SAMPLE DRY DENSITY, pcf:	119.1

TEST DATA

CLOCK TIME		TIME t	BURETTE READING; HEAD (cm)		PERMEABILITY (cm/sec) =
10-7, 10-17		(sec)	INITIAL (H ₀)	FINAL (H)	2.3(aL/At)*LOG ₁₀ (H ₀ /H)
9:25	1:30	530,400	297.94	290.72	6.4 x 10 ⁻⁹ 1 Pore Volume
1:31	2:04	261,180	298.49	294.12	7.8 x 10 ⁻⁹
2:04	8:00	64,560	294.12	293.03	8.0 x 10 ⁻⁹
8:00	5:00	32,400	293.03	292.48	8.1 x 10 ⁻⁹
5:00	7:30	52,200	292.48	291.60	8.0 x 10 ⁻⁹
AVERAGE STEADY HYDRAULIC CONDUCTIVITY, K= 8 x 10 ⁻⁹ cm/sec					

REMARKS:

REVIEWED BY: DON MICH

Appendix E-3B

Construction Documentation, May 1992

■ Construction Documentation

**Winthrop Harbor
Clay Division Berm
Stations 11700N to 12380N
Constructed May 6-29, 1992**

Prepared for:



**Browning-Ferris Industries
of Illinois, Inc.**

May 1992

~~CONSTRUCTION DOCUMENTATION~~

WINTHROP HARBOR
CLAY DIVISION BERM

STATIONS 11700N TO 12380N
CONSTRUCTED MAY 6 - MAY 29, 1992

PREPARED FOR
BROWNING-FERRIS INDUSTRIES OF ILLINOIS, INC.

May 1992

SEC Donohue Inc.
Engineers/Architects/Scientists
4738 North 40th Street
Sheboygan, WI 53083

SEC Donohue Project No. 19766

1.0 INTRODUCTION

This report documents construction, testing, and inspection for the clay division berm at Winthrop Harbor Landfill, Zion, Illinois. Project development involved construction of an approximately 680-foot long clay division berm. This portion of the clay division berm was constructed from the north end of the existing clay berm at about station 11700N, in a northerly direction to about station 12380N. The approximate limits of the clay berm and project stationing are shown on the "Existing Site Conditions" drawing, provided in Appendix A.

SEC Donohue Inc. was present during construction of the clay division berm to provide construction quality assurance services including: field observations and testing, collection of soil samples for laboratory testing, and daily documentation of construction activities. Construction quality assurance services are summarized in more detail in the following discussions.

This report constitutes certification of substantial compliance with Illinois Environmental Protection Agency (IEPA) Supplemental Permit No. 1985-226-SP, provided in Appendix B.

Personnel involved in project development and construction are as follows:

- o Browning-Ferris Industries of Illinois, Inc. - Owner
 - Don Sampson - Landfill Manager
 - John Dixon - Vice President of Operations
- o SEC Donohue Inc. - Construction Quality Assurance
 - Thomas Windau - Certifying Engineer, Project Manager
 - David Marthaler - Inspector
 - Tim McHugh - Inspector
- o Ryan, Inc. - Earthwork Contractor
 - Don Kuzik - Supervisor
- o Giles Engineering Associates, Inc. - Soil Testing Laboratory
 - Don Mich - Laboratory Supervisor

2.0 CONSTRUCTION ACTIVITIES

Construction for the clay division berm began on May 6, 1992. Ryan, Inc., performed all related earthwork activities. The location of the clay division berm was determined and set by BFI and Ryan, Inc. Fill materials utilized for construction generally consisted of a mixture of gray silty clays obtained from on-site borrow areas. Placement of the clay was performed by 20-cubic yard scrapers. After placement, each lift of clay was disced and compacted by a self-propelled sheepsfoot roller. Lift thickness was approximately 6 inches compacted. Clay lifts were tested for compaction in accordance with project specifications. Clay placement operations were complete on May 29, 1992.

Total volume of clay placed was approximately 10,170 in-place cubic yards. Clay volume calculations are provided in Appendix C. Project station cross sections are provided in Appendix D. Photographs showing clay division berm construction activities are provided in Appendix E.

3.0 INSPECTION ACTIVITIES

SEC Donohue Inc. provided continuous inspection and documentation services during construction of the clay division berm between the period of May 6 through May 29, 1992. During this period, Donohue inspectors visually observed construction activities, performed in-field density tests on compacted clay, documented location of the berm as determined by BFI and Ryan, Inc., and collected soil samples for laboratory testing. Observations were recorded on daily field reports.

A total of 28 in-field density tests were performed by SEC Donohue inspectors to monitor in-place clay moisture and density values. Clay density and moisture content were measured with a Troxler Nuclear Density/Moisture Gauge in accordance with ASTM D2922.

Material used to construct the berm was obtained from borrow area Cell 2. Laboratory data indicated a maximum dry density of 113.8 pcf for material from Cell 2. The value of 113.8 pcf was used throughout construction for determining in-place moisture content and percent compaction. Density test results indicated compaction and moisture levels meeting or exceeding project specifications of 95 percent of Standard Proctor. Field density test results are provided in Appendix F.

Clay division berm grade documentation was periodically performed to aid in estimating clay quantities. All documentation was referenced from site grid stationing. Stationing is shown on the drawing, "Existing Site Conditions", provided in Appendix A.

4.0 SOIL TESTING

Laboratory tests were performed on clay soil samples to verify index properties (i.e., Atterberg Limits and P200 content) and permeability in accordance with project specifications and IEPA Supplemental Permit No. 1985-226-SP. Laboratory soil test results are provided in Appendix G.

A total of 4 tests were performed for Atterberg Limits and P200 content determinations. Test results indicated that Plasticity Indices (PI) and P200 contents ranged from 12 to 15 and 80 to 84 percent, respectively. Based on laboratory index tests, the sidewall liner soil is classified "Gray Silty Clay" (CL) as determined by the Unified Soil Classification System.

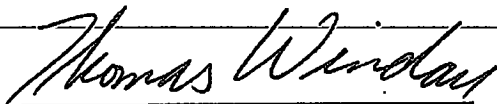
A total of 2 relatively undisturbed clay samples were recovered by Shelby tubes for laboratory hydraulic conductivity testing. Hydraulic conductivity test results indicate permeabilities of the clay samples of 1×10^{-8} cm/sec and 5×10^{-9} cm/sec, which are less than the required maximum of 1×10^{-7} cm/sec.

5.0 CONCLUSION

During construction of this portion of the clay division berm at the Winthrop Harbor facility, SEC Donohue performed quality assurance services. These services included field observations and clay density/moisture testing, and collection of soil samples for laboratory testing. In summary, field and laboratory test results showed substantial compliance to project specifications, indicating construction of the clay division berm was performed in a satisfactory manner.

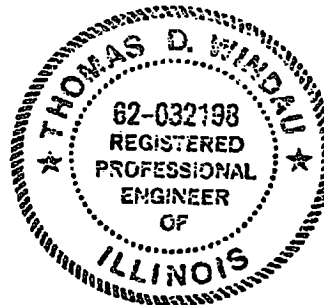
6.0 CERTIFICATION

Based on our professional judgement on information obtained through on-site observations and field and laboratory soil test results, the clay division berm for the Winthrop Harbor facility was constructed in substantial accordance with project specifications.



Thomas Windau, P.E.
Certifying Engineer

RP/BFIWINTH/AA8



APPENDIX A
EXISTING SITE CONDITIONS



May 29, 1992

Mr. Jerry O'Zee
Browning-Ferris Industries of Illinois, Inc.
Winthrop Harbor Landfill
701 Green Bay Road
Zion, IL 60099

Re: Winthrop Harbor Clay Division Berm
Construction Documentation Report
Stations 11700N to 12380N
SEC Donohue Project No. 19766

Dear Jerry:

The above referenced construction documentation report was provided to BFII on Wednesday, May 27, 1992. This correspondence serves to correct an error within the construction documentation report.

In several locations within the document, the duration of the project was identified as May 6, 1992, through May 29, 1992. Construction documentation activities at the site were completed on Friday, May 22, 1992. Therefore, in all instances within the document where the duration of construction documentation activities is identified, dates should be corrected to read May 6, 1992, through May 22, 1992.

We apologize for any inconvenience this error may have caused. A copy of this correspondence will be forwarded to Mark Retzlaff, IEPA Maywood office.

Sincerely,

SEC DONOHUE INC.

A handwritten signature in cursive script that reads "Nancy J. Richardson".

Nancy J. Richardson, P.E.

NJR/bjz

cc: Mark Retzlaff, IEPA
Mike Williams, BFI
Tom Windau, SEC Donohue

TR/L/YW1





4738 North 40th Street
Sheboygan, Wisconsin 53083

Ph. (414) 458-8711

LETTER OF TRANSMITTAL

DATE	5-26-92	JOB NO.	19766
ATTENTION			
RE: Waukegan Clay Division Beim Construction			

TO Jerry O'zee
Browning-Ferris Industries of Illinois
701 Green Bay Road
Zion, IL 60099

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items:

- ☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1			Construction Documentation Report

THESE ARE TRANSMITTED as checked below:

- ☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☐ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☒ As requested ☐ Returned for corrections ☐ Return _____ corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19 _____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS

Jerry,
Attached is one copy of the clay berm
construction report. Please let me know if
you'd like more copies and if one should go
to the regional office (Schaumburg or Minneapolis?)

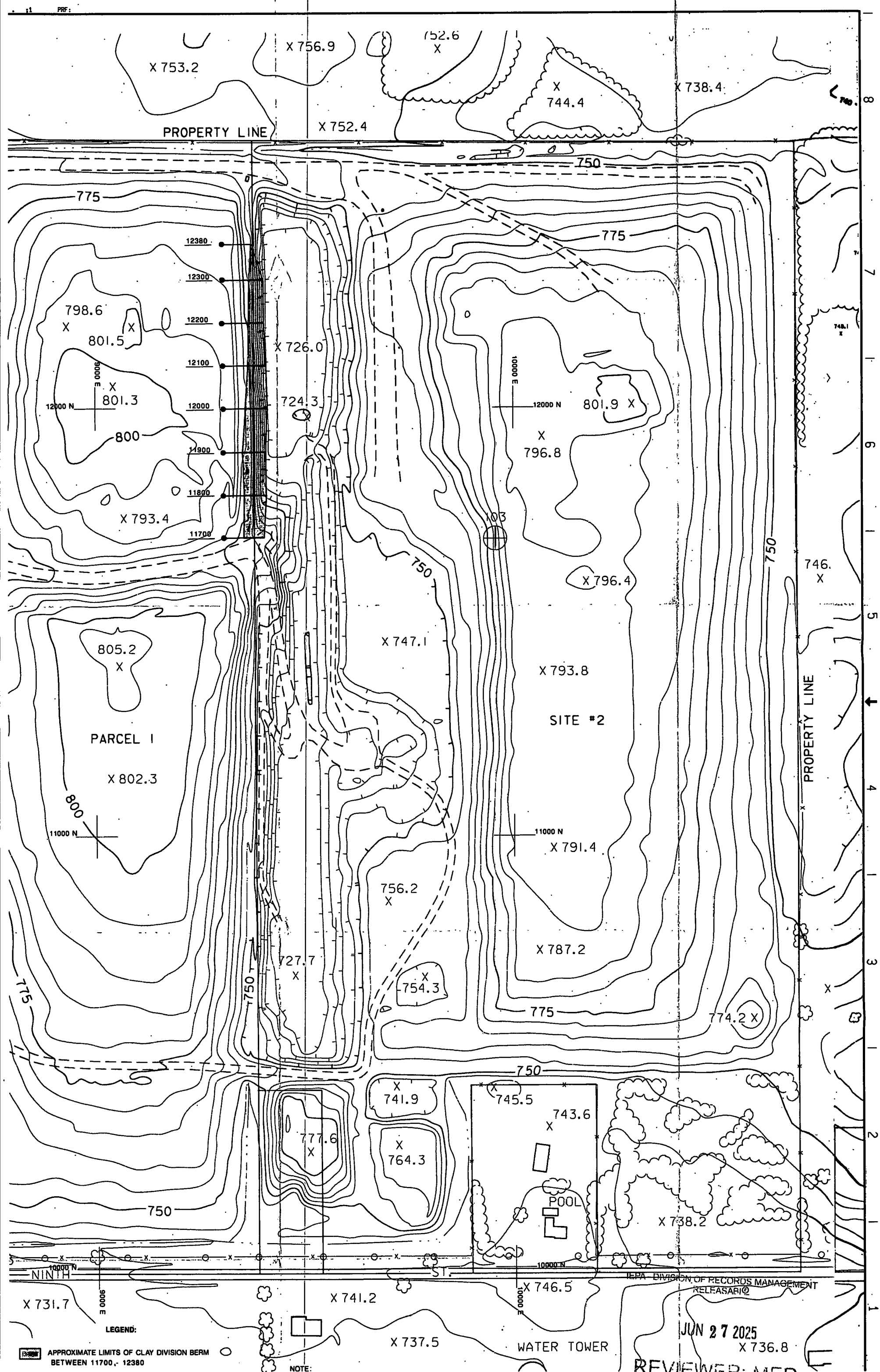
Thanks

you to study
problem

COPY TO Tom Windey

SIGNED:

Wendy Richardson



APPENDIX B

**ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
SUPPLEMENTAL PERMIT**



217/782-6762

Refer to: 0978020001 — Lake County
Winthrop Harbor/BFI #1
Supplemental Permit No. 1985-226-SP
Log Nos. 1985-090 and 1985-226

March 20, 1986

Browning-Ferris Industries
1827 Walden Office Square, Suite 107
Schaumburg, Illinois 60195

Gentlemen:

Supplemental permit is hereby granted to Browning-Ferris Industries, as owner and operator, to construct a berm along the eastern boundary of the above-referenced solid waste management site and to deposit non-hazardous waste in the area between this berm and the existing contours of the site. Final plans, specifications, application and supporting documents as submitted and approved shall constitute part of this permit and are identified in the records of the Illinois Environmental Protection Agency, Division of Land Pollution Control by the permit number and log number designated in the heading above.

This supplemental permit is issued subject to the standard conditions attached hereto and incorporated herein by reference, and further subject to the following special conditions:

1. In case of conflict between the application and plans submitted and these special conditions, the special conditions of this permit shall govern development and operation of the subject site.
2. Only nonhazardous wastes may be disposed in the area which is the subject of this permit.
3. After receipt at the site, but prior to disposal, every container of waste to be disposed in this area shall be sampled and analyzed by the paint filter test described in 35 Ill. Adm. Code 729.320. No wastes that yield fluid may be deposited in this area.
4. The diversion berm shall be constructed in accordance with the specifications identified in the document entitled "Slope Stability Analysis, Winthrop Harbor Landfill Nos. 1 & 2, Waukegan, Illinois," by Donohue and Associates, dated December, 1985. To ensure these specifications are met, the Construction Documentation Program in Appendix B of this document shall be adhered to, with the following exceptions:



Page 2

- a. Lifts of soil no more than nine inches thick (+) shall be used in constructing the berms;
 - b. Each lift shall be disced prior to compacting;
 - c. The soil placed in each lift shall be approximately three to five percent above the optimum moisture content to ensure the desired permeability is obtained upon compaction. If the moisture content of the soil excavated for use is below this level, water shall be added to obtain the desired moisture content.
 - d. Each lift shall be compacted to 95% of the Standard Proctor density (ASTM: D698);
 - e. The field density of each compacted lift shall be determined on 200 feet intervals. ASTM methods shall be used in making this determination;
 - f. One lab moisture density test shall be conducted for every 5000 cubic yards of soil used in constructing the berm, or when the borrow soil changes. The P200, clay content (less than 0.002 mm), grain size distribution curve, Atterburg limits and USCS soil classification shall be determined at the same frequency.
 - g. Provisions shall be made to key the bottom of each successive ten foot berm into the top of the lower berm. This may include scarifying and wetting the top of the lower berm prior to placing the initial lift of the upper berm. Other procedures may also be used to key the upper berm into the lower berm.
5. A registered professional engineer shall certify that the soil used in the construction of the berm:
- a. Is compacted to a minimum density which is 95 percent of the Standard Proctor Density (ASTM:D698);
 - b. Has an in-place permeability no greater than 1×10^{-7} cm/sec.

This certification shall be submitted to the Agency, as described in Special Condition No. 6 below. A report from a registered professional engineer documenting that the berm was constructed in accordance with the procedures set forth in Special Condition No. 4 above shall also be submitted to the Agency. These documents shall be developed each time a portion of the berm is constructed, and shall be submitted to the Agency before waste is placed against the newly constructed berm.



Page 3

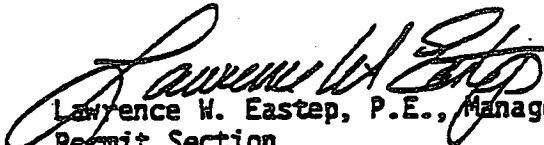
6. Unless otherwise indicated, all certifications, logs, reports and plan sheets which are required to be submitted to the Agency by the permittee shall be mailed to the following address:

Illinois Environmental Protection Agency
Compliance Monitoring Section
Division of Land Pollution Control — #24
2200 Churchill Road
Springfield, Illinois 62706

7. Prior to placing waste against a portion of the newly constructed berm, the berm shall be inspected and approved by the Field Operations Section of this Division.

Except as modified in the above documents and in any supplemental permits issued by the Agency, this site shall be developed and operated in accordance with the terms and conditions of Permit No. 1975-53-OP, dated November 11, 1975.

Very truly yours,


Lawrence W. Eastep, P.E., Manager
Permit Section
Division of Land Pollution Control

LWE:JKM:rd0601F/1-3

Attachment

cc: Division File
Northern Region
Donohue and Associates
Fred Prillaman

VOLUME CALCULATIONS

APPENDIX C

Volume Calculations

STATION 11700

ELEV	OFFSET		
779.2	9350	7308117	7162100
766	9379	7218018	7184314
766	9423	7200400	7316865
776.49	9400	7283476	7393288
786.52	9380	7369692	7376995
786.46	9370	7353401	7301104
779.2	9350	0	0
		43733104	43734666
		AREA	

780.835 SQ. FT

STATION 11800

ELEV	OFFSET		
785.59	9345	7345267	7298445
781	9350	7312503	7255600
776	9363	7280432	7265688
776	9382	7294400	7280432
776	9400	7302160	7366968
783.72	9410	7372454	7390990
785.44	9407	7367427	7399452
786.59	9380	7370348	7375869
786.34	9370	7352279	7362852
786.34	9351	7348347	7346052
785.79	9350	7343208	7345267
785.59	9345	0	0
		80688825	80687616
		AREA	

604.635 SQ. FT.

STATION 11900

ELEV	OFFSET		
788.13	9340	7369016	7303880
782	9350	7319520	7293000
780	9360	7327320	7272720
777	9394	7313901	7256865
772.5	9413	7276950	7353530
781.21	9420	7347280	7375389
782.95	9405	7344071	7373990
784.05	9380	7346549	7357578
784.39	9370	7331693	7357886
785.26	9347	7334328	7366651
788.13	9340	0	0
		0	0
		73310628	73311489
		AREA	

430.855 SQ. FT.

STATION 12000

ELEV	OFFSET		
783.95	9356	7351099	7241544
774	9377	7272504	7257798
774	9396	7283340	7323242
779.4	9410	7310772	7354950
781.61	9380	7323686	7339006
782.41	9370	7320228	7345612
783.95	9356	0	0

0	0
0	0
0	0
0	0
0	0
0	0
0	0

43861629 43862152

AREA

261.495 SQ. FT.

STATION 12100

ELEV	OFFSET		
780.42	9363	7629386	7246962
774	9776	7283340	7604359
777.86	9410	7296327	7334060
779.39	9380	7302884	7315837
779.94	9370	7302578	7312535
780.42	9363	0	0
0	0	0	0

0	0
0	0
0	0
0	0
0	0

36814515 36813754

AREA

380.69 SQ. FT.

STATION 12200

ELEV	OFFSET		
784	9350	7358624	7166775
766.5	9386	7211999	7194369
766.5	9409	7214298	7269299
772.59	9412	7263891	7299759
775.58	9402	7274940	7305918
777.06	9380	7281052	7290042
777.19	9370	7277607	7396678
789.4	9364	7380890	7341376
784	9350	0	0

0	0
0	0
0	0

58263301 58264217

AREA

457.575 SQ. FT.

220.035 SQ. FT.

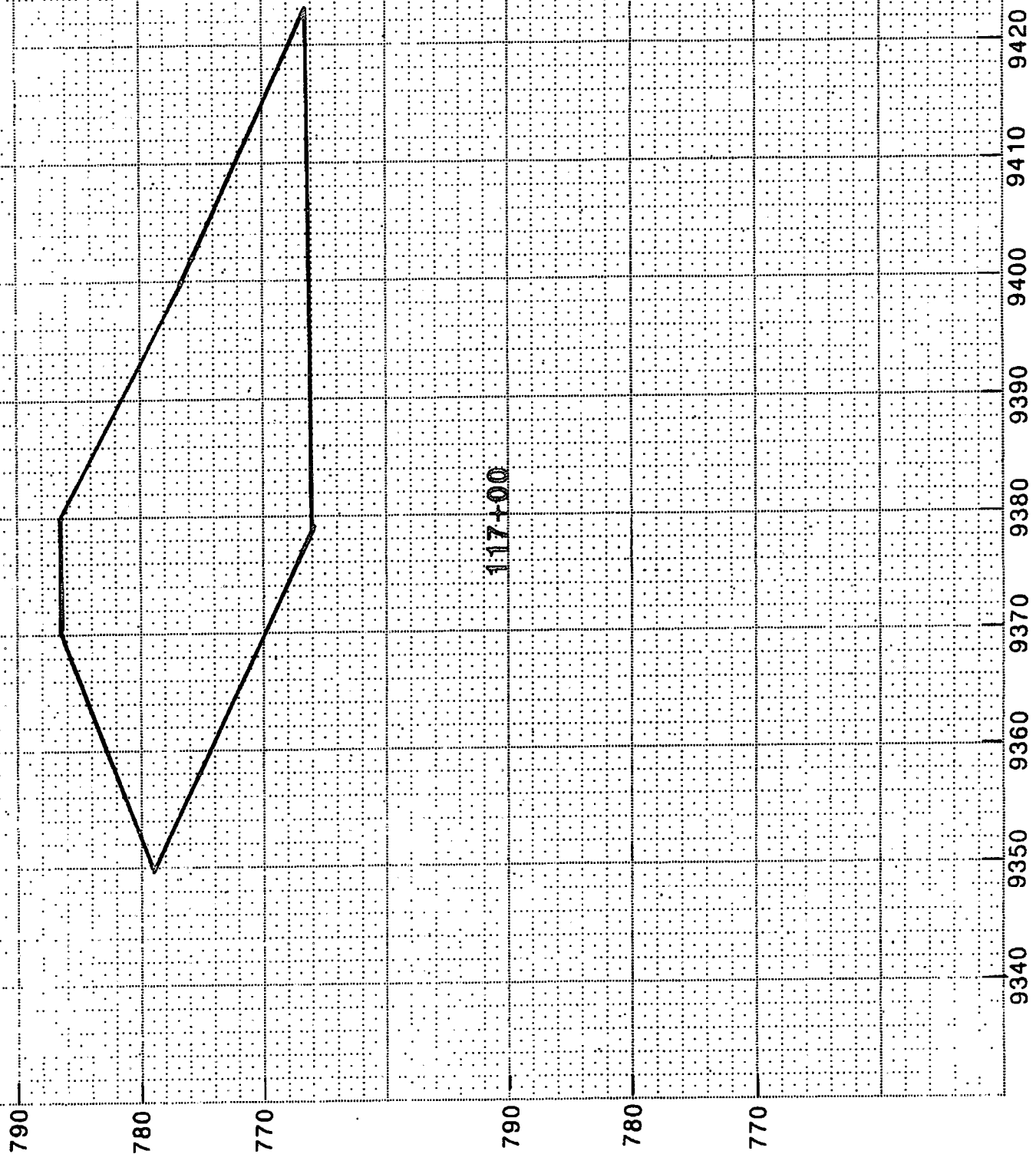
0 SQ. FT.

SUMMARY

STATION	AREA	SUM	AVE	LENGTH	YARDS	CUM YDS
11700	780.835	1385.47	692.735	100	2565.69	2565.69
11800	604.635	1035.49	517.745	100	1917.57	4483.26
11900	430.855	692.35	346.175	100	1282.13	5765.39
12000	261.495	642.185	321.0925	100	1189.23	6954.62
12100	380.69	838.265	419.1325	100	1552.34	8506.96
12200	457.575	677.61	338.805	100	1254.83	9761.80
12300	220.035	220.035	110.0175	100	407.47	10169.27
12400	0					

CLAY DIVISION BERM CROSS-SECTIONS

APPENDIX D



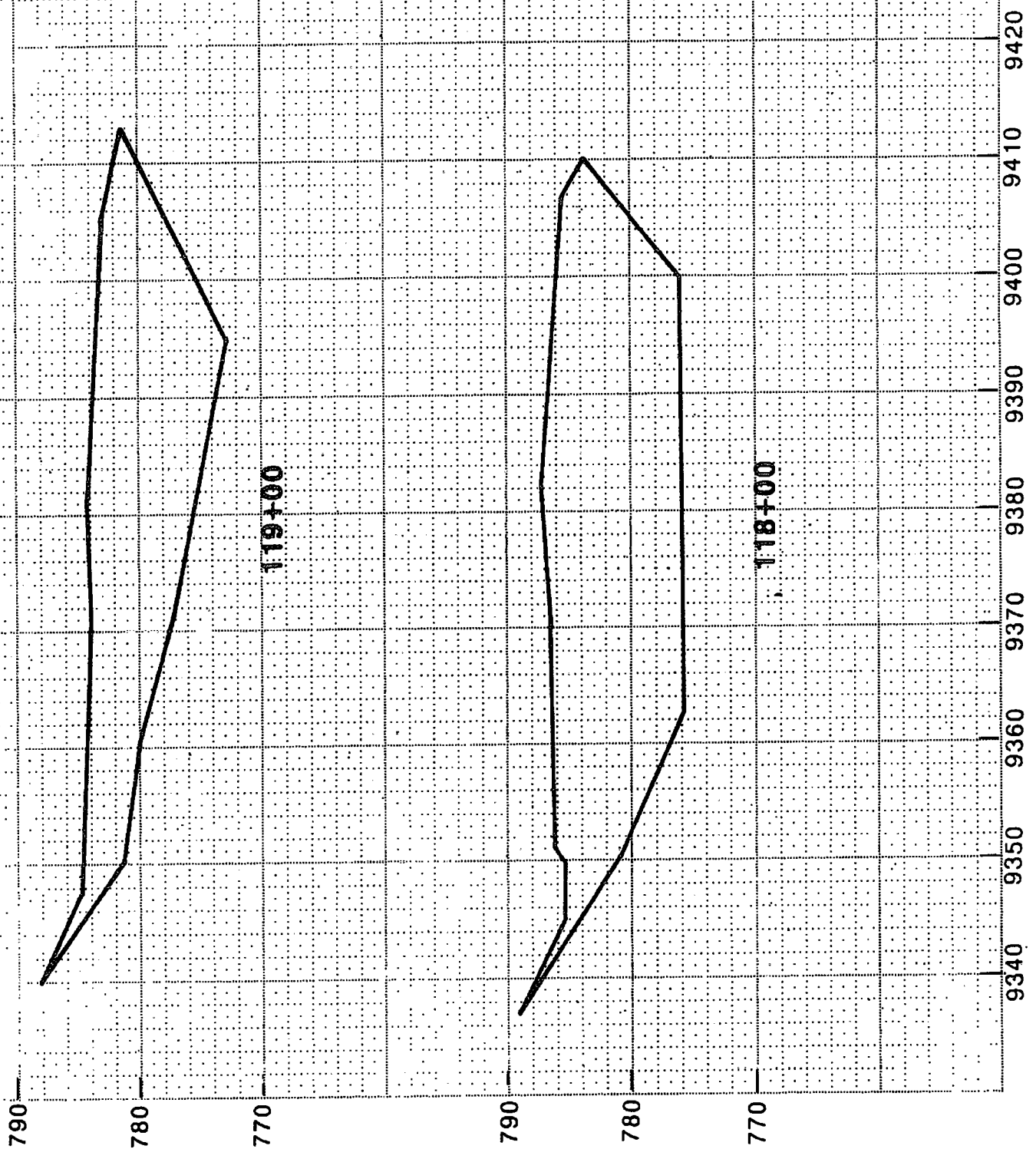
MAY, 1992

CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

19766.300

Donohue ENGINEERS
ARCHITECTS
SCIENTISTS

R 001000

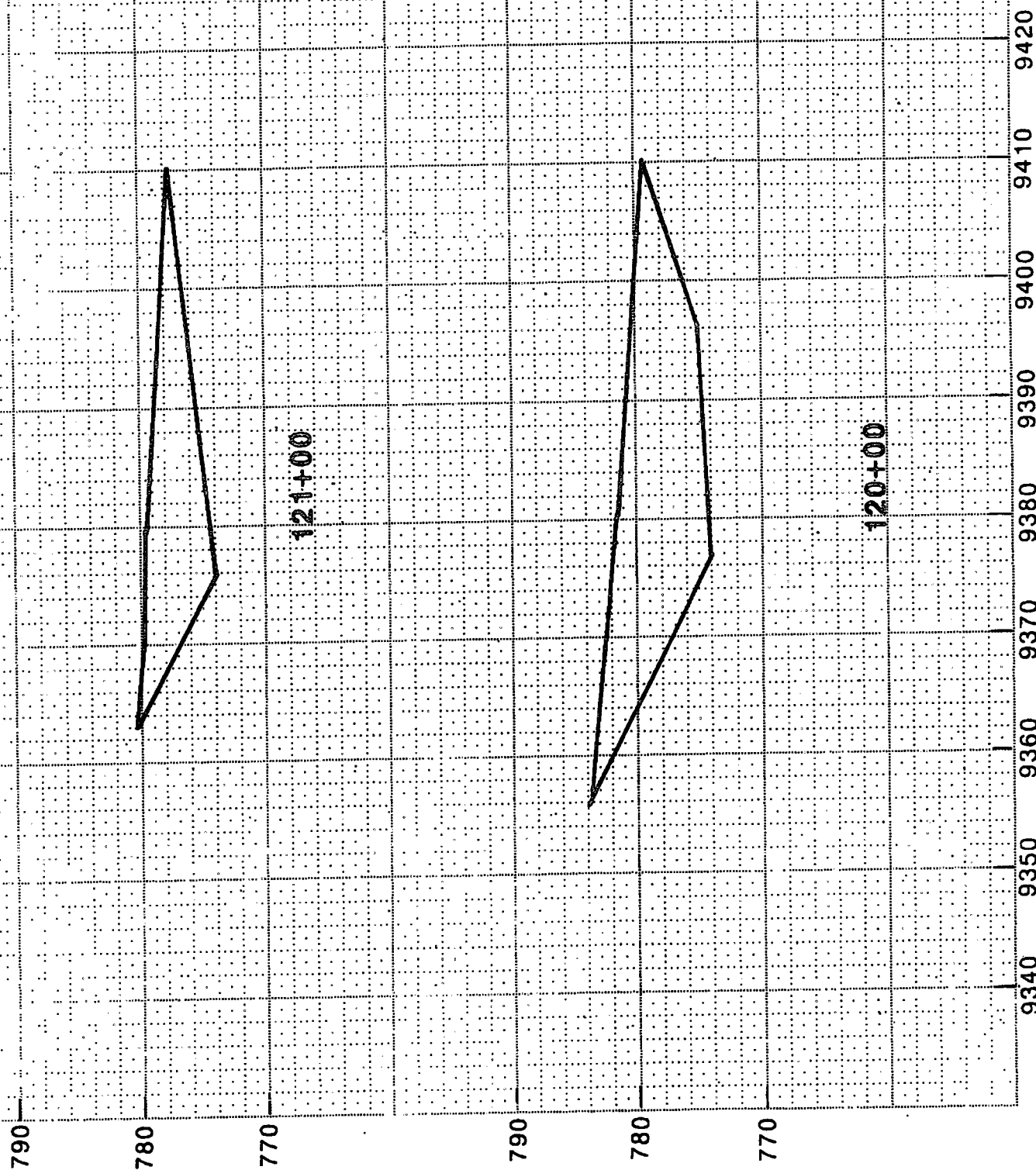


MAY, 1992

CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

19766.300

Donohue ENGINEERS
ARCHITECTS
SCIENTISTS



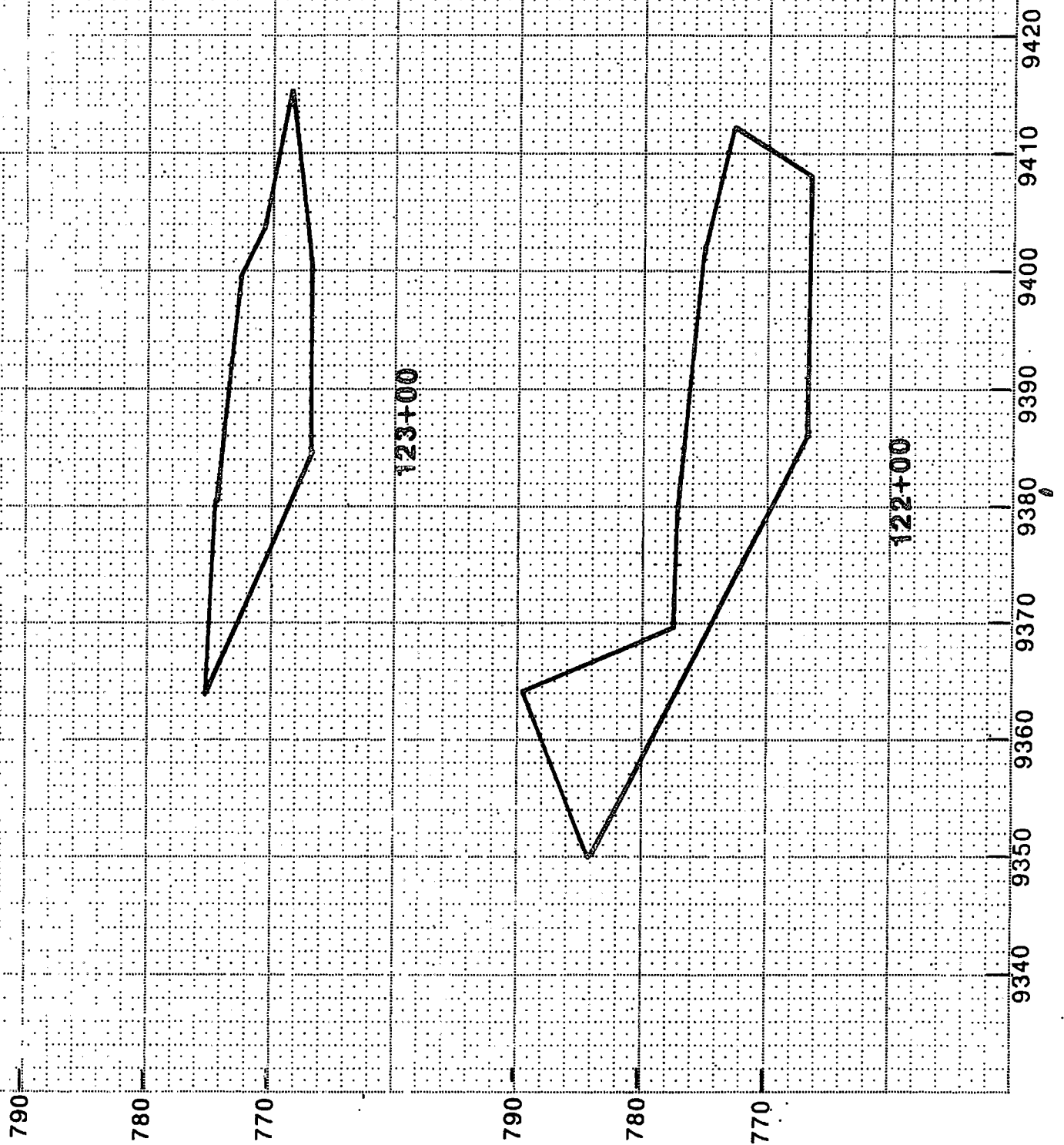
MAY, 1992

CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

19766.300

Donohue ENGINEERS
ARCHITECTS
SCIENTISTS

R:001002



MAY, 1992

CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

19766.300

Donohue ENGINEERS
ARCHITECTS
SCIENTISTS

APPENDIX E
PHOTOGRAPHS

PHOTOS TO BE PROVIDED UNDER SEPARATE COVER.

APPENDIX F

FIELD DENSITY TEST RESULTS

BFI
WINTHROP HARBOR
19766.200

DATE	TEST	RETEST	STATION	OFFSET	DESCR	ELEV	DEPTH	WET	DRY	MOIST	MOIST %	PROCTOR	COMPACT
05/08/92	3.01		117+15	5 RT	BSC	784.6	12	140.0	125.5	14.5	11.6	113.8	110.3
05/08/92	3.02		117+13	5 LT	BSC	784.6	12	137.4	122.6	14.8	12.1	113.8	107.7
05/09/92	4.01		117+79	0	BSC	781.0	12	126.4	111.1	15.3	13.8	113.8	97.6
05/11/92	6.01		117+50	-5 LT	BSC	782.0	12	126.7	111.5	15.2	13.6	113.8	98.0
05/12/92	7.01		119+00	0	BSC	782.0	12	125.0	107.1	17.9	16.7	113.8	94.1
05/12/92	7.02	7.01	119+00	0	BSC	782.0	12	127.5	111.0	16.5	14.9	113.8	97.5
05/12/92	7.03		120+95	0	BSC	777.0	12	127.4	111.0	16.4	14.8	113.8	97.5
05/12/92	7.04		122+25	1	BSC	774.0	12	128.8	113.5	15.3	13.5	113.8	99.7
05/13/92	8.01		123+00	5 RT	BSC	772.0	12	126.7	111.3	15.4	13.8	113.8	97.8
05/13/92	8.02		121+15	5 LT	BSC	778.0	12	129.9	114.9	15.0	13.1	113.8	101.0
05/13/92	8.03		123+00	5 RT	BSC	772.0	12	128.4	113.2	15.2	13.4	113.8	99.5
05/13/92	8.04		122+00	0	BSC	773.0	12	126.5	111.1	15.4	13.9	113.8	97.6
05/13/92	8.05		114+60	0	BSC	790.0	12	124.8	108.9	15.9	14.6	113.8	95.7
05/14/92	9.01		116+90	5 RT	BSC	788.0	12	127.5	112.6	14.9	13.2	113.8	98.9
05/14/92	9.02		119+05	CL	BSC	784.0	12	129.3	114.7	14.8	12.7	113.8	100.8
05/14/92	9.03		121+00	-5 LT	BSC	778.0	12	127.1	111.5	15.6	14.0	113.8	98.0
05/15/92	10.01		117+00	5	BROWN	788.0	12	125.9	110.7	15.2	13.7	113.8	97.3
05/15/92	10.02		122+00	-5	BROWN	776.0	12	128.6	114.0	14.6	12.8	113.8	100.2
05/26/92	21.01		123+70	CL	GSC	772.0	12	140.4	123.9	16.5	13.3	113.8	108.9
05/26/92	21.02		123+00	CL	GSC	774.0	12	137.0	121.3	15.7	12.9	113.8	106.6
05/26/92	21.03		122.50	5 LT	GSC	775.0	12	135.7	120.7	15.0	12.4	113.8	106.1
05/26/92	21.04		122+00	5 LT	GSC	775.0	12	131.7	116.8	14.9	12.8	113.8	102.6
05/26/92	21.05		122.50	CL	GSC	775.0	12	135.8	119.4	16.4	13.7	113.8	104.9
05/26/92	21.06		122+00	CL	GSC	777.0	12	134.8	118.6	16.2	13.7	113.8	104.2
05/26/92	21.07		121+75	CL	GSC	778.0	12	140.7	125.6	15.1	12.0	113.8	110.4
05/26/92	21.08		121+50	CL	GSC	781.0	12	138.0	122.0	16.0	13.1	113.8	107.2
05/26/92	21.09		119+50	CL	GSC	783.0	12	138.4	122.6	15.8	12.9	113.8	107.7
05/26/92	21.10		118+00	CL	GSC	786.0	12	138.4	122.4	16.0	13.1	113.8	107.6

APPENDIX G

SOIL LABORATORY TEST RESULTS



MILWAUKEE, WI
LOS ANGELES, CA

GILES ENGINEERING ASSOCIATES, INC.
 GEOTECHNICAL, GEO ENVIRONMENTAL, GEO-HYDROLOGICAL
 AND CONSTRUCTION MATERIALS CONSULTANTS

□ N8 W22350 JOHNSON ROAD SUITE A1/WAUKESHA, WI 53186/414-774-0118/FAX: 414-549-5868
 □ 4875 EAST LA PALMA AVENUE SUITE 807/ANAHEIM, CA 92807/714-779-0052/FAX: 714-779-0068

REPORT OF LABORATORY TESTING

Client: SEC Donohue
Sheboygan, WI

Project: BFI Zion Facility
Zion, IL

Date: May 22, 1992

GEA Project No. 1M-920436

In accordance with your request, laboratory testing was performed on the following samples for Winthrop Harbor Landfill. Laboratory testing was performed in general accordance with ASTM Test Procedures D4318, D422, D698 and D5084.

Sample No.	Location/Description	Grainsize Analysis		Atterberg Limits	
		Percent Finer Than No. 200 Sieve	Clay Content 0.002 mm	Liquid Limit	Plastic Limit
1-U	117+00 East edge Gray silty clay with sand	84.1	30.9	28	15
2-U	122+00 West edge Gray silty clay with sand	82.6	31.4	28	15
3-R	117+00 East edge Gray-brown silty clay with sand	82.8	34.2	29	15
4-R	122+00 West edge Gray-brown silty clay with sand	80.7	28.9	26	12
Range		80.7-84.1	28.9-32.2	26-29	12-15
Mean Average		82.6	31.4	27.8	14.3

BFI Zion Facility
 Zion, Illinois
 GEA Project No. 1M-920436-1
 May 22, 1992
 Page 2

Moisture-Density Relationship

Sample No.	Location/ Description	Proctor Analysis	Optimum Moisture
		Maximum Dry Density (pcf)	Content (%)
1R	Cell 1 Gray silty clay with sand	120.6	11.7
2R	Cell 2 Gray silty clay with sand	113.8	14.0
3R	Cell 1 117+00 East edge Gray silty clay with sand	120.5	13.2
4R	Cell 1 122+00 Brown-Gray silty clay with sand	122.5	12.1
Range		113.8-122.5	11.7-14.0
Mean Average		119.4	12.8

BFI Zion Facility
Zion, Illinois
GEA Project No. 1M-920436-1
May 22, 1992
Page 3

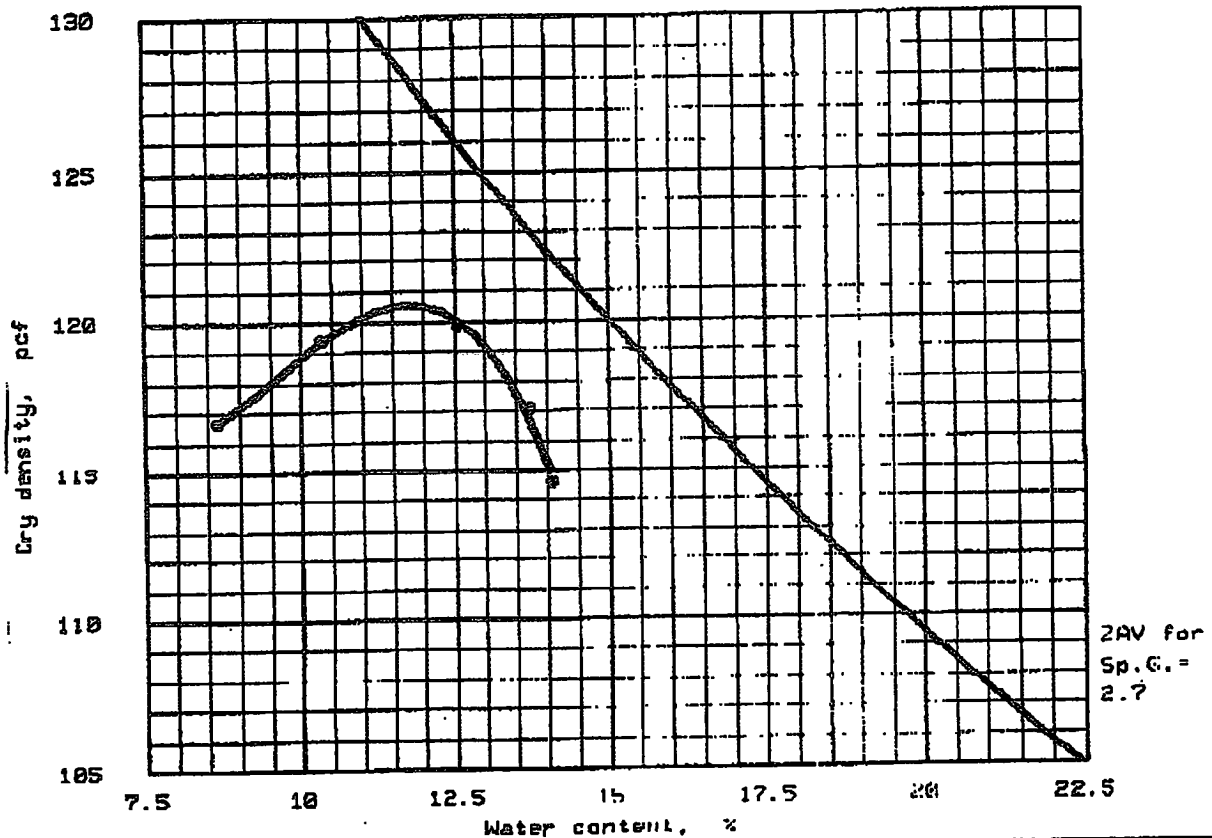
Hydraulic Conductivity (cm/sec.)

<u>Sample No.</u>	<u>Location/ Description</u>	<u>Result</u>
1-U	117+00 East edge Gray silty clay with sand	5 X 10 ⁻⁹
2-U	122+00 West edge Gray silty clay with sand	1 X 10 ⁻⁸

REVIEWED BY: Don Mich

May92\16/car/BU132

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method II

Maximum dry density = 120.6 pcf

Optimum moisture = 11.7 %

Soil ID	Classification		Nat. Moist.	Sp. G.	PI	% > No. 4	% < No. 200
	USCS	AASHTO					
	CL		15.1 %	2.7			

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay

1R Cell 1

Project No.: 1M-920496

Project: BFI-Zion Facility

Client: BFI Waste Systems

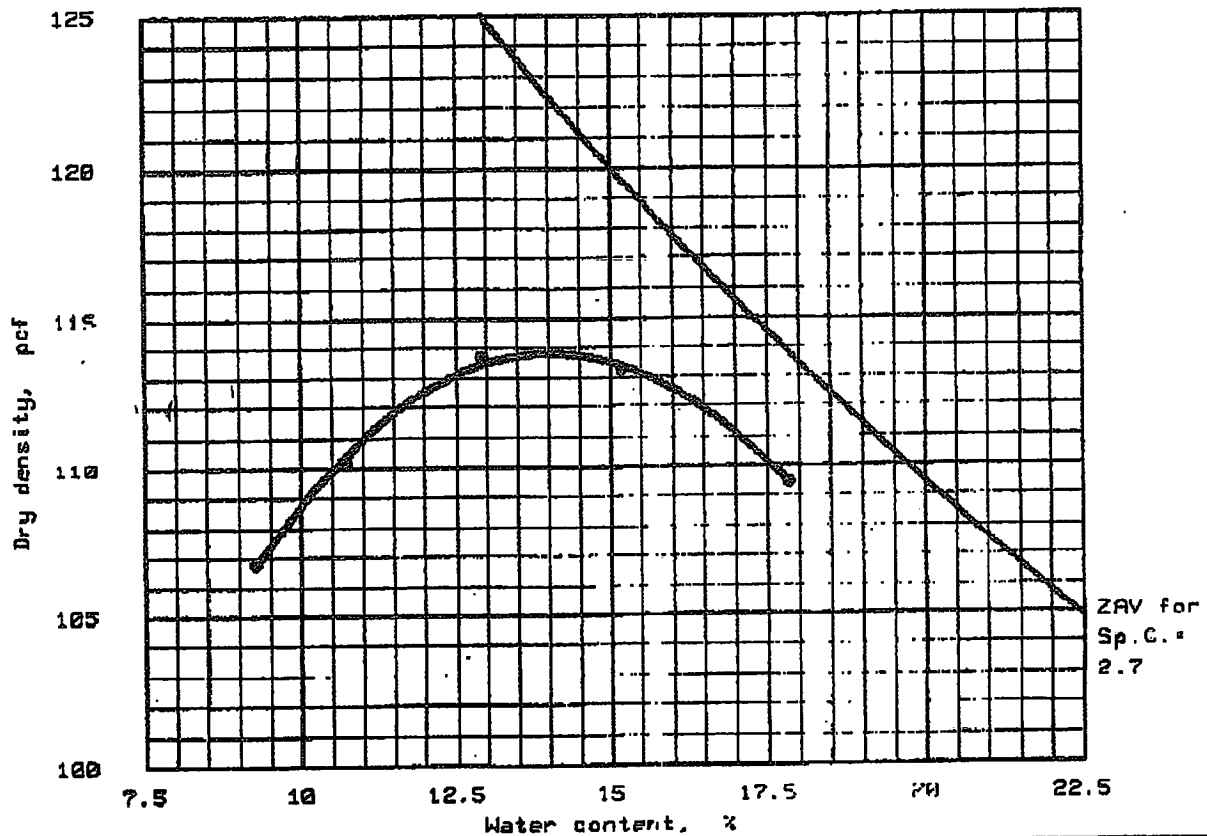
Date: 5-1-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 113.8 pcf

Optimum moisture = 14.8 %

Soil ID	Classification		Nat. Moist.	Sp. G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
	CL		11.7 %	2.7				

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

2R Cell 1

Project No.: 1M-920436

Project: BFI-Zion Facility

Client: BFI Waste Systems

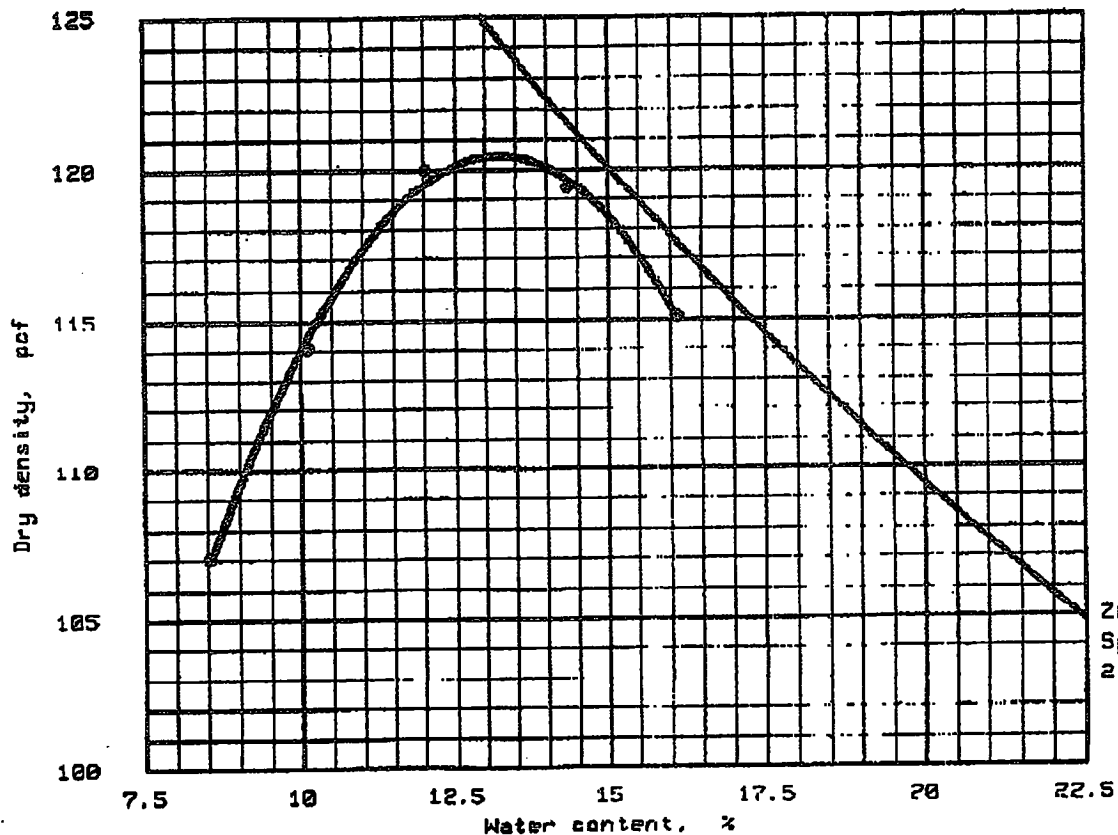
Date: 5-1-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT


ZAV for
Sp.G. =
2.7

"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 120.5 pcf

Optimum moisture = 13.4 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
			15.4 %	2.7				

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray-Brown Silty Clay
with Sand

3-R 117+00 East Edge Cell 1

Project No.: 1M-920496
Project: BFI-Zion Facility
Client: BFI Waste Systems

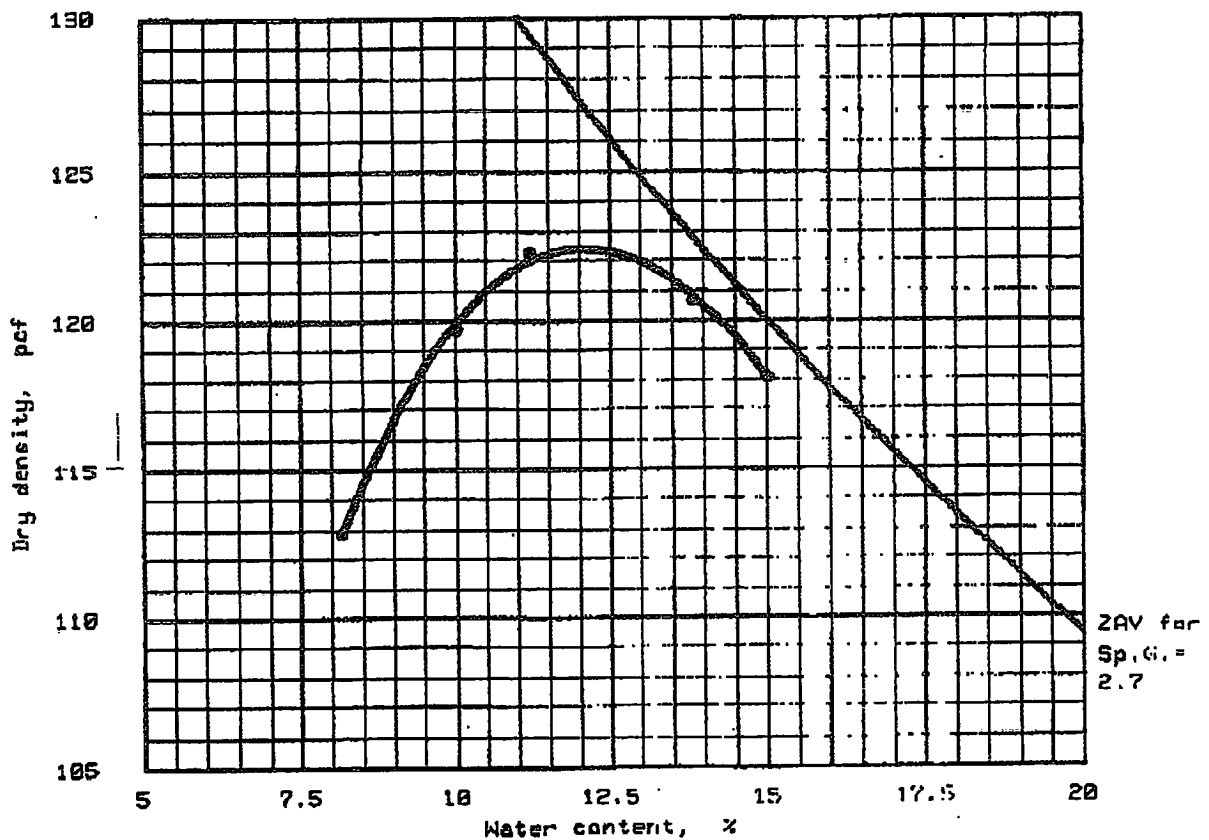
Remarks:

Date: 5-22-1992

Giles Engineering Assoc., Inc.

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 122.5 pcf

Optimum moisture = 12.1 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PF	% > No. 4	% < No. 200
	USCS	AASHTO						
			14.8 %	2.7				

MATERIAL DESCRIPTION

Brown-Gray Silty Clay
with Sand

SAMPLE LOCATION

4-R 1221M0 Cell 01

Project No.: 1M-920436

Project: BFI-Zion Facility

Client: BFI Waste Systems

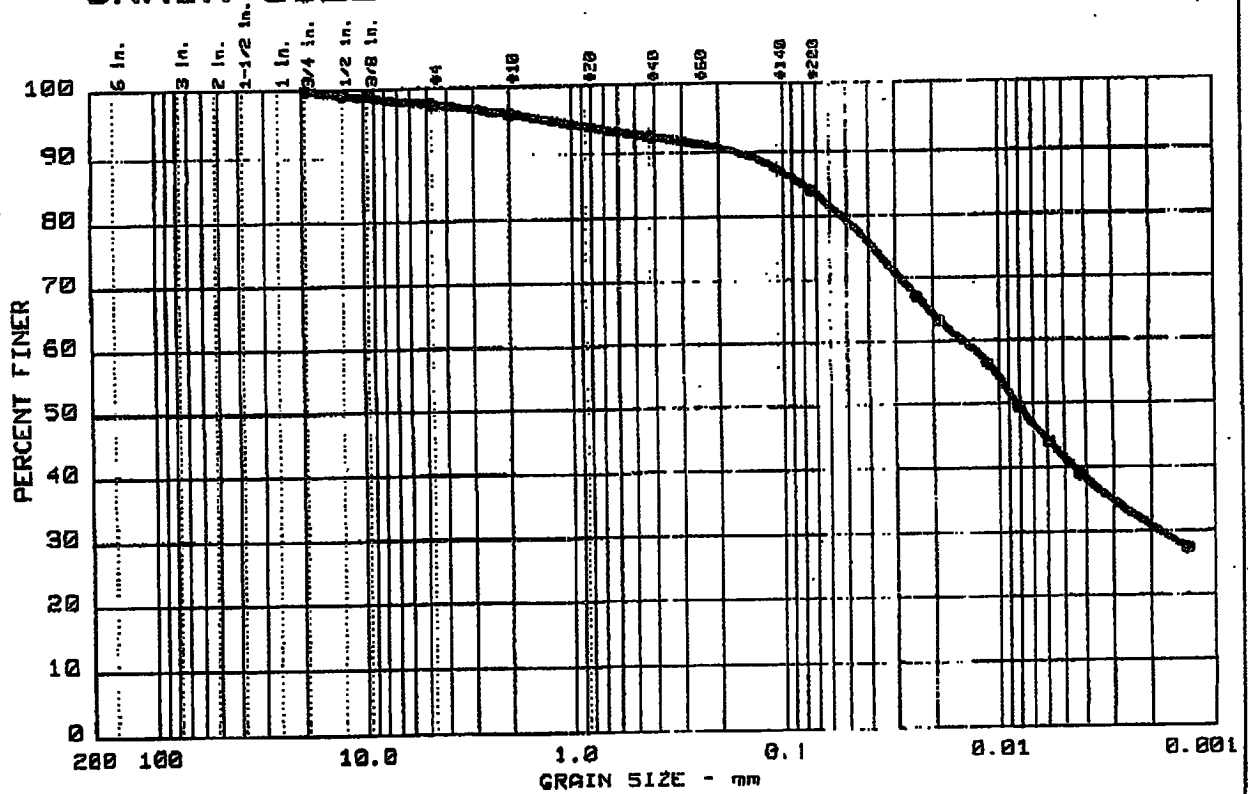
Date: 5-22-1992

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
2	0.0	2.3	13.6	53.2	30.9	CI	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
13.0	28	15	13.0	2.7		0.002			

MATERIAL DESCRIPTION	SAMPLE LOCATION
Gray Silty Clay with Sand	Station 117+00 East Edge

Project No.: IM-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

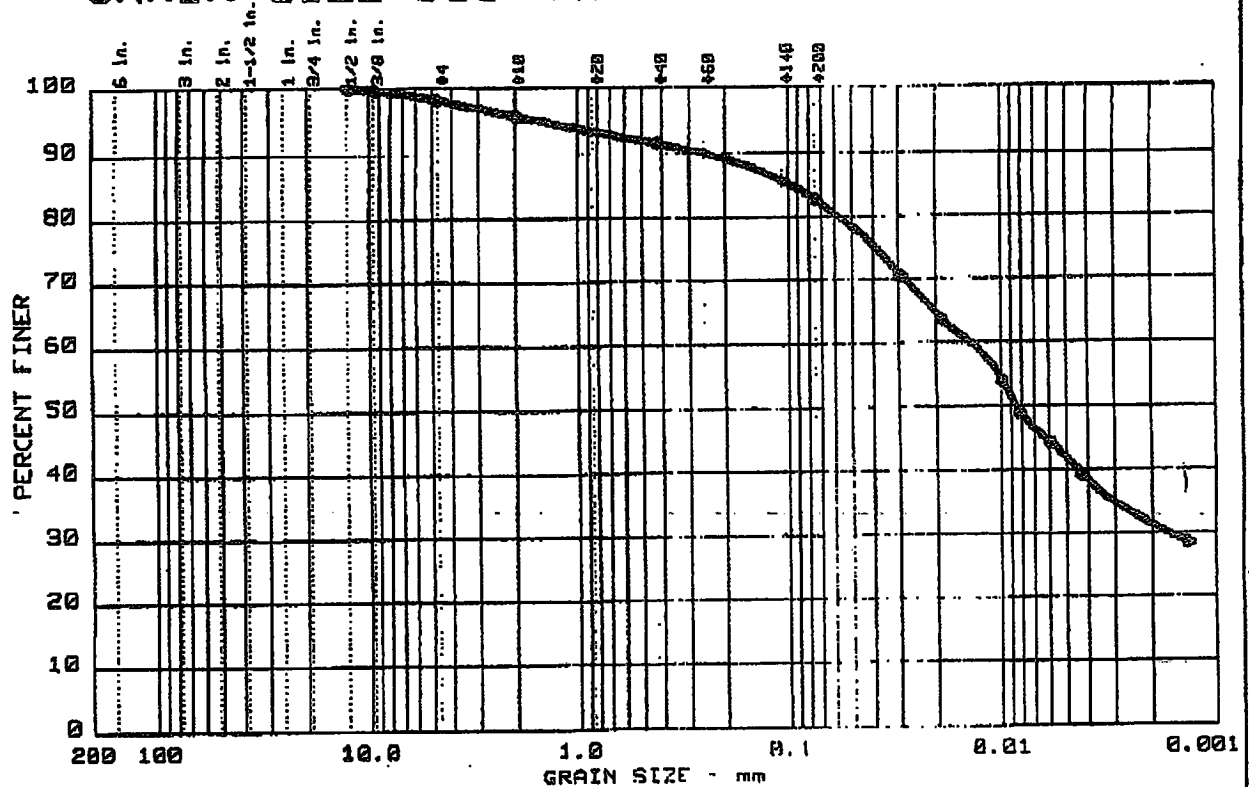
Date: 5-21-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
4	0.0	1.7	15.7	51.2	31.4	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
11.7	28	15	13.0	2.7		0.002			

MATERIAL DESCRIPTION	SAMPLE LOCATION
Gray Silty Clay with Sand	2-11 122+00 West Edge

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

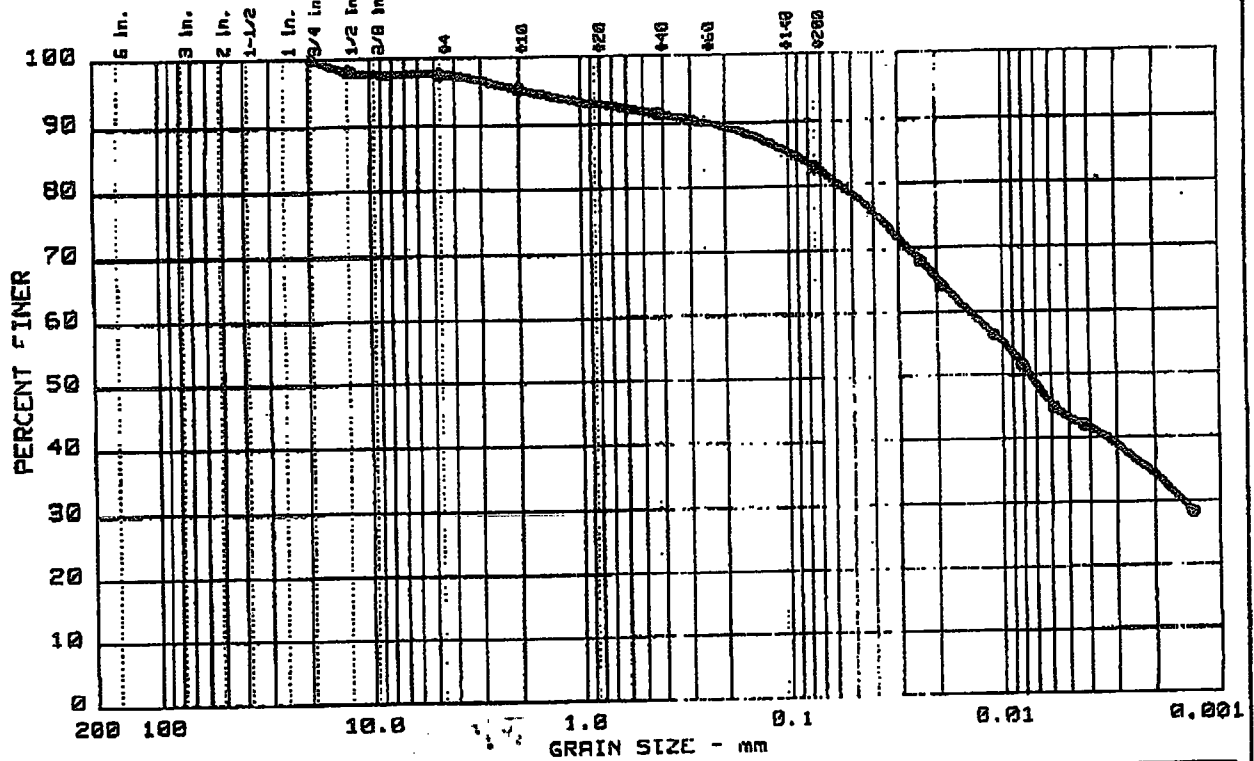
Date: 5-21-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
3	0.0	2.3	14.9	48.6	34.2	CL	

NM	LL	PL	PI	Sp-Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
12.9	29	15	14.0	2.7		0.075			

MATERIAL DESCRIPTION	SAMPLE LOCATION
Gray-Brown Silty Clay with Sand	HR 117+00 East Edge

Project No.: IM-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

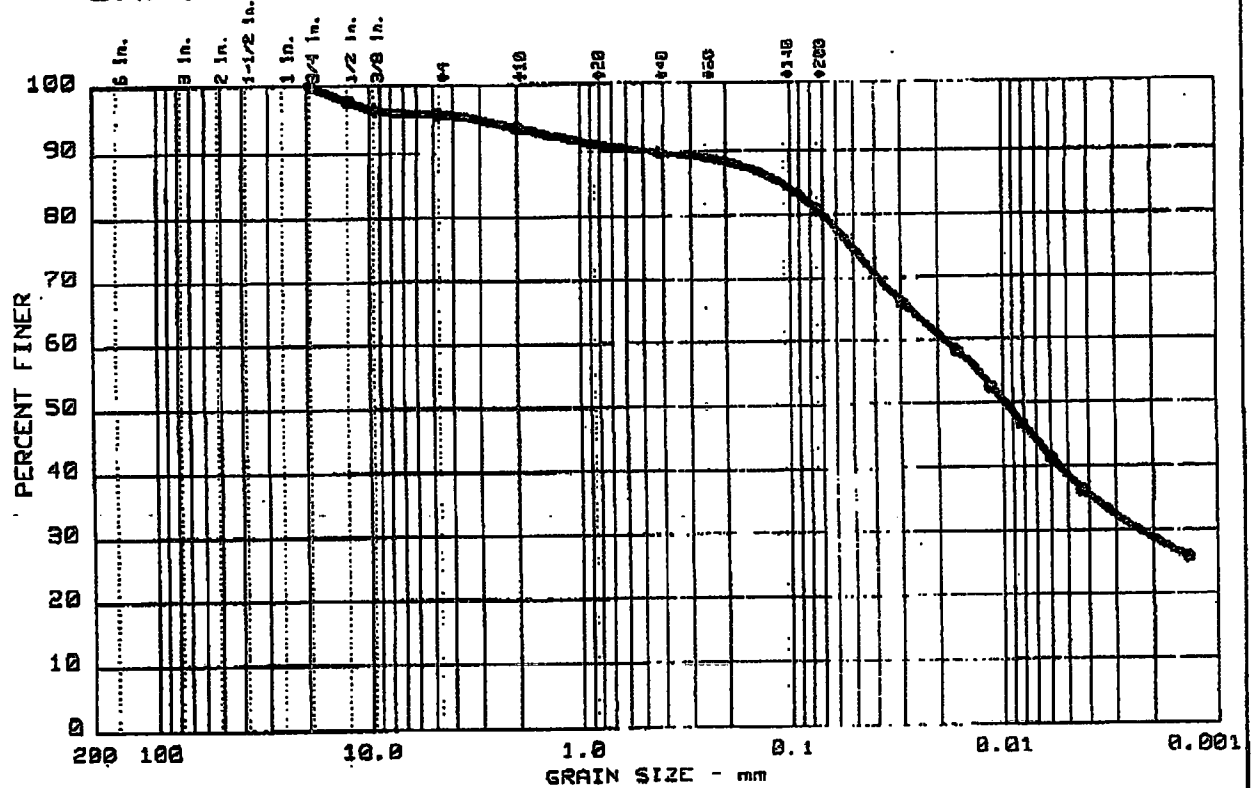
Date: 5-21-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
5	0.0	4.2	15.1	51.8	28.9		

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₉₀	D ₁₀	C _c	C _u
13.4	26	12	14.0	2.7		0.002			

MATERIAL DESCRIPTION	SAMPLE LOCATION
Gray-Brown Silty Clay with Sand	4-R 122+00 West Edge

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

Date: 5-21-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.



MILWAUKEE, WI
LOS ANGELES, CA

GILES ENGINEERING ASSOCIATES, INC.

GEOTECHNICAL GEO-ENVIRONMENTAL GEO-HYDROLOGICAL
AND CONSTRUCTION MATERIALS CONSULTANTS

☐ N8 W22350 JOHNSON ROAD/WAUKESHA, WI 53186/414-544-0118/FAX: 414-549-5888
☐ 4879 EAST LA PALMA AVENUE SUITE 201/ANAHEIM, CA 92807/714-779-0057/FAX: 714-779-0068

REPORT OF FLEXIBLE WALL PERMEABILITY TEST (ASTM DRAFT METHOD)

CLIENT: SEC Donohue
Sheboygan, WI

PROJECT: RFT Zion Facility
Zion, IL

DATE: May 22, 1992

PROJECT NO.: 1M-920436-1

SAMPLE DESCRIPTION: Gray silty clay with sand
SAMPLE LOCATION: 1-U 117+00 East edge

SOIL SAMPLE CHARACTERISTICS

SOIL CLASSIFICATION: CL
NATURAL MOISTURE: - 13.0
LIQUID LIMIT: - 28
PLASTIC LIMIT: - 15

PERCENT FINER NO. 200: - 84.1
MAX. DRY DENSITY, pcf: -
OPTIMUM MOISTURE, %: -

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.6
SAMPLE DIAMETER (D), cm: 7.24
SAMPLE AREA (A), sq. cm: 41.16
SAMPLE MOISTURE, %: 13.0
SAMPLE DRY DENSITY, pcf: 122.7

MEMBRANE TYPE: Larox .025"
PERMEANT FLUID: Distilled, Deaired Water
CONSOLIDATION PRESSURE, psi: 7.0
B PARAMETER: .92
HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

cell no.: 1

CLOCK TIME		TIME T	BURRETTE CHANGE		FLOW Q	PERMEABILITY = Q/TC.0006L/A*H
5-20, 5-22		(min)	lower / upper		(ml)	(cm/sec)
1:05	5:10	245	0.4	0.3	0.35	5.4 X 10 ⁻⁹
5:10	7:50	880	1.3	1.3	1.3	5.6 X 10 ⁻⁹
7:50	1:10	320	0.4	0.5	0.45	5.3 X 10 ⁻⁹
1:10	4:40	210	0.3	0.3	0.3	5.4 X 10 ⁻⁹
4:40	7:10	870	1.3	1.3	1.3	5.7 X 10 ⁻⁹
AVERAGE STEADY HYDRAULIC CONDUCTIVITY, K= 5 X 10 ⁻⁹ cm/sec						

REMARKS:

REVIEWED BY: Don Mich



MILWAUKEE, WI
LOS ANGELES, CA

GILES ENGINEERING ASSOCIATES, INC.

GEOTECHNICAL GEO-ENVIRONMENTAL GEO-HYDROLOGICAL
AND CONSTRUCTION MATERIALS CONSULTANTS

☐ N8 W22350 JOHNSON ROAD/WALUKESHA, WI 53186/414-544-0118/FAX: 414-549-5858
☐ 4879 EAST LA PALMA AVENUE SUITE 201/ANAHEIM, CA 92807/714-779-0057/FAX: 714-779-0088

REPORT OF FLEXIBLE WALL PERMEABILITY TEST (ASTM DRAFT METHOD)

CLIENT: SEC Donohue
Sheboygan, WI

PROJECT: BFI Zion Facility
Zion, IL

DATE: May 22, 1992

PROJECT NO.: 1M-920436-1

SAMPLE DESCRIPTION: Gray silty clay with sand
SAMPLE LOCATION: 2-U 122+00 West edge

SOIL SAMPLE CHARACTERISTICS

SOIL CLASSIFICATION: CL

NATURAL MOISTURE: = 11.7

LIQUID LIMIT: = 28

PLASTIC LIMIT: = 15

PERCENT FINER NO. 200: = 82.6

MAX. DRY DENSITY, pcf: =

OPTIMUM MOISTURE, %: =

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.6

SAMPLE DIAMETER (D), cm: 7.24

SAMPLE AREA (A), sq cm: 41.16

SAMPLE MOISTURE, %: 11.7

SAMPLE DRY DENSITY, pcf: 125.7

MEMBRANE TYPE: Latex .025

PERMEANT FLUID: Distilled, Deaired Water

CONSOLIDATION PRESSURE, psi: 7.0

B PARAMETER: .92

HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

cell no.: 2

CLOCK TIME 5-20, 5-22	TIME T (min)	BURRETTE CHANGE lower / upper	FLOW Q (ml)	PERMEABILITY = Q/T(.0006L/A*H) (cm/sec)
1:05 5:10	245	1.0 1.0	1.0	1.6×10^{-8}
5:10 7:50	880	2.8 3.0	2.9	1.3×10^{-8}
7:50 1:10	320	0.8 0.9	0.85	1.0×10^{-8}
1:10 4:40	210	0.55 0.5	0.525	9.5×10^{-9}
4:40 7:10	870	2.25 2.3	2.275	9.9×10^{-9}
AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 1 \times 10^{-8}$ cm/sec				

REMARKS:

REVIEWED BY: Don Mich

Appendix E-3C

Construction Documentation, May/June 1992

▲ Construction Documentation

**Winthrop Harbor
Clay Division Berm
Stations 10580 to 11700
Constructed May 6 - June 2, 1992**

Prepared for:



**Browning-Ferris Industries
of Illinois, Inc.**

June 1992

CONSTRUCTION DOCUMENTATION

**WINTHROP HARBOR
CLAY DIVISION BERM**

**STATIONS 10580 TO 11700
CONSTRUCTED MAY 6 - JUNE 2, 1992**

PREPARED FOR

BROWNING-FERRIS INDUSTRIES OF ILLINOIS, INC.

June 1992

**SEC Donohue Inc.
4738 North 40th Street
Sheboygan, WI 53083**

SEC Donohue Project No. 19766

1.0 INTRODUCTION

This report documents construction, testing, and inspection for the clay division berm at Winthrop Harbor Landfill, Zion, Illinois. Project development involved construction of an approximately 1,120 feet long clay division berm. This portion of the clay division berm was constructed from the north end of the existing clay berm at about Station 11700N, in a southerly direction to about Station 10580N. The approximate limits of the clay berm and project stationing are shown on the "Existing Site Conditions" drawing, provided in Appendix A.

SEC Donohue Inc. was present during construction of the clay division berm to provide construction quality assurance services including: field observations and testing, collection of soil samples for laboratory testing, and daily documentation of construction activities. Construction quality assurance services are summarized in more detail in the following discussions.

This report constitutes certification of substantial compliance with Illinois Environmental Protection Agency (IEPA) Supplemental Permit No. 1985-226-SP, provided in Appendix B.

Personnel involved in project development and construction are as follows:

- o Browning-Ferris Industries of Illinois, Inc. - Owner
 - Don Sampson - Landfill Manager
 - John Dixon - Vice President of Operations
- o SEC Donohue Inc. - Construction Quality Assurance
 - Thomas Windau - Certifying Engineer, Project Manager
 - David Marthaler - Inspector
 - Tim McHugh - Inspector
 - Jim Michels - Inspector
- o Ryan, Inc. - Earthwork Contractor
 - Don Kuzik - Supervisor
- o Giles Engineering Associates, Inc. - Soil Testing Laboratory
 - Don Mich - Laboratory Supervisor

2.0 CONSTRUCTION ACTIVITIES

Construction for the clay division berm began on May 6, 1992. Ryan, Inc., performed all related earthwork activities. The location of the clay division berm was determined and set by BFI and Ryan, Inc. Fill materials utilized for construction generally consisted of a mixture of gray silty clays obtained from on-site borrow areas. Placement of the clay was performed by 20-cubic yard scrapers. After placement, each lift of clay was disced and compacted by a self-propelled sheepsfoot roller. Lift thickness was approximately 6 inches compacted. Clay lifts were tested for compaction in accordance with project specifications. Berm construction activities were complete on June 2, 1992.

Total volume of clay placed was approximately 14,153 in-place cubic yards. Clay volume calculations are provided in Appendix C. Project station cross sections are provided in Appendix D. Photographs showing clay division berm construction activities are provided in Appendix E.

3.0 INSPECTION ACTIVITIES

SEC Donohue Inc. provided continuous inspection and documentation services during construction of the clay division berm between the period of May 6 through June 2, 1992. During this period, SEC Donohue inspectors visually observed construction activities, performed in-field density tests on compacted clay, documented location of the berm as determined by BFI and Ryan, Inc., and collected soil samples for laboratory testing. Observations were recorded on daily field reports.

A total of 66 in-field density tests were performed by the SEC Donohue inspector to monitor in-place clay moisture and density values. Clay density and moisture content were measured with a Troxler Nuclear Density/Moisture Gauge in accordance with ASTM D2922.

Material used to construct the berm was obtained from borrow area Cell 1 and Cell 2. Laboratory data indicated a maximum dry density of 120.6 pcf, optimum moisture 11.7 percent for material from Cell 1; and a maximum dry density of 113.8 pcf, optimum moisture 14.0 percent for material from Cell 2. Density test results indicated compaction meeting or exceeding project specifications of 95 percent of Standard Proctor. Field density test results are provided in Appendix F.

Clay division berm grade documentation was periodically performed to aid in estimating clay quantities. All documentation was referenced from site grid stationing. Stationing is shown on the drawing, "Existing Site Conditions", provided in Appendix A.

4.0 SOIL TESTING

Laboratory tests were performed on clay soil samples to verify index properties (i.e., Atterberg Limits and P200 content) and permeability in accordance with project specifications and IEPA Supplemental Permit No. 1985-226-SP. Laboratory soil test results are provided in Appendix G. The laboratory report in Appendix G includes results for three clay division berm projects:

- 1) Station 11700N to 12380N constructed May 6 through May 27, 1992;
- 2) Station 10580N to 11700N constructed May 6 through June 2, 1992; and
- 3) Station 11700N to 12380N constructed June 2 through June 11, 1992.

For this project, a total of six tests were performed for Atterberg Limits and P200 content determinations. Test results indicated that Plasticity Indices (PI) and P200 contents ranged from 12 to 14 and 80.8 to 86.5 percent, respectively. Based on laboratory index tests, the sidewall liner soil is classified "Gray Silty Clay" (CL) as determined by the Unified Soil Classification System.

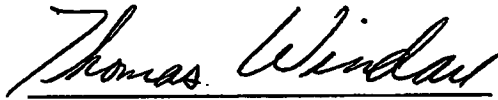
Four relatively undisturbed clay samples were recovered by Shelby tubes for laboratory hydraulic conductivity testing. The Shelby tubes were pushed at N11100, lift 5; N 11500, lift 6; N10800, lift 8; and N 11650, lift 9. Hydraulic conductivity test results indicate permeabilities of the clay samples of 9×10^{-9} cm/sec, 2×10^{-8} , 1×10^{-8} , and 2×10^{-8} cm/sec, which are less than the required maximum of 1×10^{-7} cm/sec.

5.0 CONCLUSION

During construction of this portion of the clay division berm at the Winthrop Harbor facility, SEC Donohue performed quality assurance services. These services included field observations and clay density/moisture testing, and collection of soil samples for laboratory testing. In summary, field and laboratory test results showed substantial compliance to project specifications, indicating construction of the clay division berm was performed in a satisfactory manner.

6.0 CERTIFICATION

Based on our professional judgement on information obtained through on-site observations and field and laboratory soil test results, the clay division berm for the Winthrop Harbor facility was constructed in substantial accordance with project specifications.

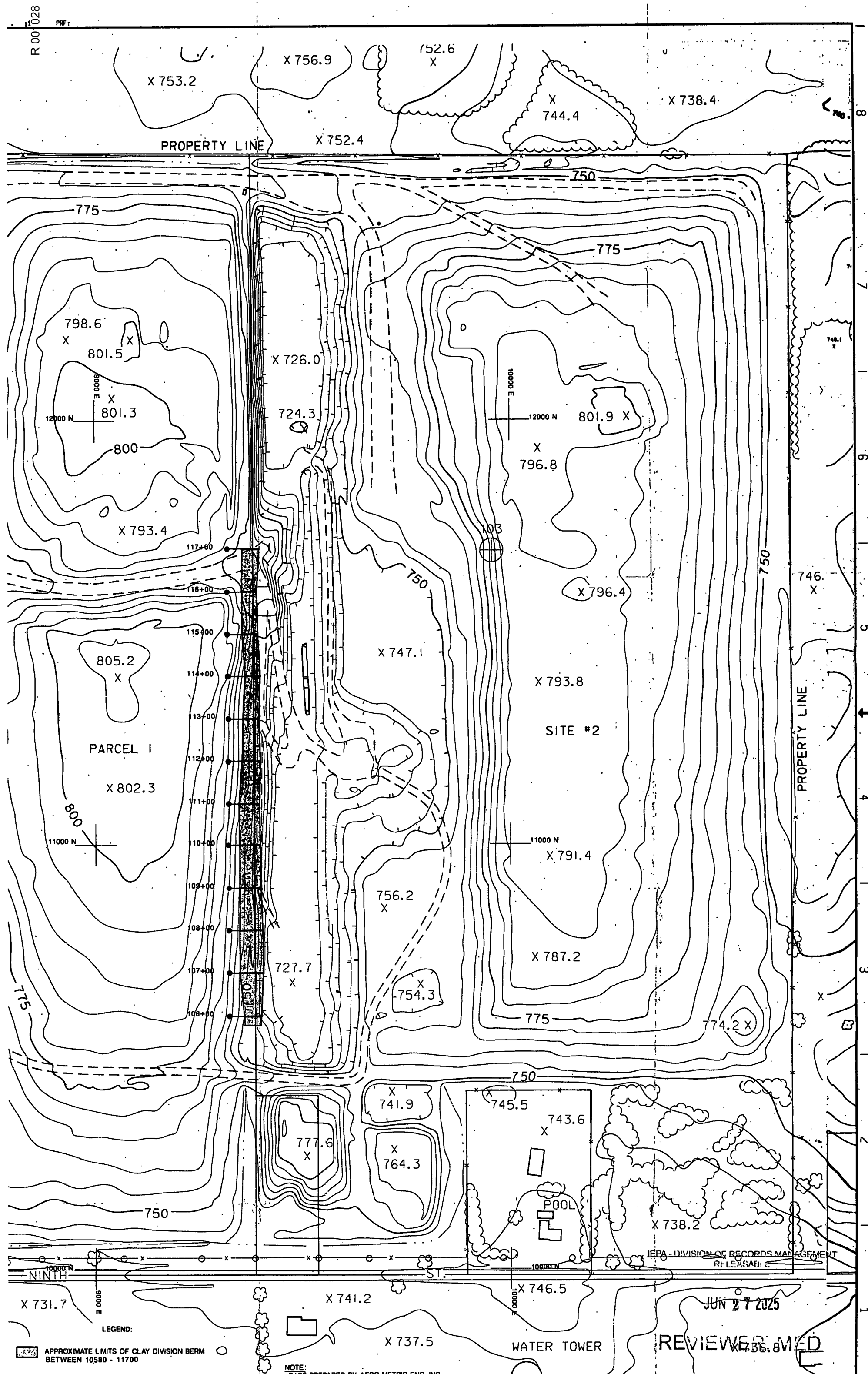


Thomas Windau, P.E.
Certifying Engineer

RP/BFIWINTH/AB4



APPENDIX A
EXISTING SITE CONDITIONS



APPENDIX B

**ILLINOIS ENVIRONMENTAL PROTECTION
AGENCY SUPPLEMENTAL PERMIT**



217/782-6762

Refer to: 0978020001 — Lake County
Winthrop Harbor/BFI #1
Supplemental Permit No. 1985-226-SP
Log Nos. 1985-090 and 1985-226

March 20, 1986

Browning-Ferris Industries
1827 Walden Office Square, Suite 107
Schaumburg, Illinois 60195

Gentlemen:

Supplemental permit is hereby granted to Browning-Ferris Industries, as owner and operator, to construct a berm along the eastern boundary of the above-referenced solid waste management site and to deposit non-hazardous waste in the area between this berm and the existing contours of the site. Final plans, specifications, application and supporting documents as submitted and approved shall constitute part of this permit and are identified in the records of the Illinois Environmental Protection Agency, Division of Land Pollution Control by the permit number and log number designated in the heading above.

This supplemental permit is issued subject to the standard conditions attached hereto and incorporated herein by reference, and further subject to the following special conditions:

1. In case of conflict between the application and plans submitted and these special conditions, the special conditions of this permit shall govern development and operation of the subject site.
2. Only nonhazardous wastes may be disposed in the area which is the subject of this permit.
3. After receipt at the site, but prior to disposal, every container of waste to be disposed in this area shall be sampled and analyzed by the paint filter test described in 35 Ill. Adm. Code 729.320. No wastes that yield fluid may be deposited in this area.
4. The diversion berm shall be constructed in accordance with the specifications identified in the document entitled "Slope Stability Analysis, Winthrop Harbor Landfill Nos. 1 & 2, Waukegan, Illinois," by Donohue and Associates, dated December, 1985. To ensure these specifications are met, the Construction Documentation Program in Appendix B of this document shall be adhered to, with the following exceptions:



Page 2

- a. Lifts of soil no more than nine inches thick (+) shall be used in constructing the berms;
 - b. Each lift shall be disced prior to compacting;
 - c. The soil placed in each lift shall be approximately three to five percent above the optimum moisture content to ensure the desired permeability is obtained upon compaction. If the moisture content of the soil excavated for use is below this level, water shall be added to obtain the desired moisture content.
 - d. Each lift shall be compacted to 95% of the Standard Proctor density (ASTM: D698);
 - e. The field density of each compacted lift shall be determined on 200 feet intervals. ASTM methods shall be used in making this determination;
 - f. One lab moisture density test shall be conducted for every 5000 cubic yards of soil used in constructing the berm, or when the borrow soil changes. The P200, clay content (less than 0.002 mm), grain size distribution curve, Atterburg limits and USCS soil classification shall be determined at the same frequency.
 - g. Provisions shall be made to key the bottom of each successive ten foot berm into the top of the lower berm. This may include scarifying and wetting the top of the lower berm prior to placing the initial lift of the upper berm. Other procedures may also be used to key the upper berm into the lower berm.
5. A registered professional engineer shall certify that the soil used in the construction of the berm:
- a. Is compacted to a minimum density which is 95 percent of the Standard Proctor Density (ASTM:D698);
 - b. Has an in-place permeability no greater than 1×10^{-7} cm/sec.

This certification shall be submitted to the Agency, as described in Special Condition No. 6 below. A report from a registered professional engineer documenting that the berm was constructed in accordance with the procedures set forth in Special Condition No. 4 above shall also be submitted to the Agency. These documents shall be developed each time a portion of the berm is constructed, and shall be submitted to the Agency before waste is placed against the newly constructed berm.



Page 3

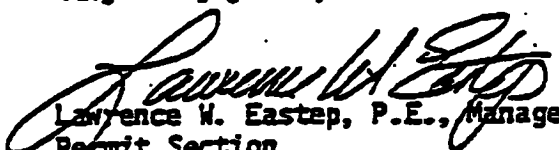
6. Unless otherwise indicated, all certifications, logs, reports and plan sheets which are required to be submitted to the Agency by the permittee shall be mailed to the following address:

Illinois Environmental Protection Agency
Compliance Monitoring Section
Division of Land Pollution Control — #24
2200 Churchill Road
Springfield, Illinois 62706

7. Prior to placing waste against a portion of the newly constructed berm, the berm shall be inspected and approved by the Field Operations Section of this Division.

Except as modified in the above documents and in any supplemental permits issued by the Agency, this site shall be developed and operated in accordance with the terms and conditions of Permit No. 1975-53-OP, dated November 11, 1975.

Very truly yours,


Lawrence W. Eastep, P.E., Manager
Permit Section
Division of Land Pollution Control

LWE:JKM:rd0601F/1-3

Attachment

cc: Division File
Northern Region
Donohue and Associates
Fred Prillaman

APPENDIX C
VOLUME CALCULATIONS

VOLUME COMPUTATIONS

Donohue
Engineers & Architects

CLIENT BFI - WINTHROP HARBOR PAGE NO. 1
PROJECT SOUTH END CLAY DIVISION BERM PROJECT NO. 19766
DATE 6/25/92 BY TDW CHECKED BY PS
CUT OR FILL MATERIAL _____
CIRCLE CUT

STATION	SECTION LIMITS	DISTANCE	END AREA	TOTAL OF END AREAS	AVERAGE END AREA	VOLUME
105+80			0			
		20		126.4	63.2	1,264
106			126.4			
		100		538.5	269.25	26,925
107			412.1			
		100		990.8	495.4	49,540
108			578.7			
		100		973.6	486.8	48,680
109			394.9			
		100		736.6	368.3	36,830
110			341.7			
		100		683.4	341.7	34,170
111			341.7			
		100		650.4	325.2	32,520
112			308.7			
		100		604.5	302.25	30,225
113			295.8			
		100		578.7	289.35	28,935
114			282.9			
		100		539.9	269.95	26,995
115			257.0			

COMMENTS:

VOLUME COMPUTATIONS

Donohue

Engineers & Architects

CLIENT BFI- PAGE NO. 2

PROJECT SOUTH END
CLAY BERM PROJECT NO. 19766

DATE 6/25/92 BY 70W CHECKED BY _____

CUT OR FILL 1
:CIRCLE ONE.

MATERIAL _____

[illegible]

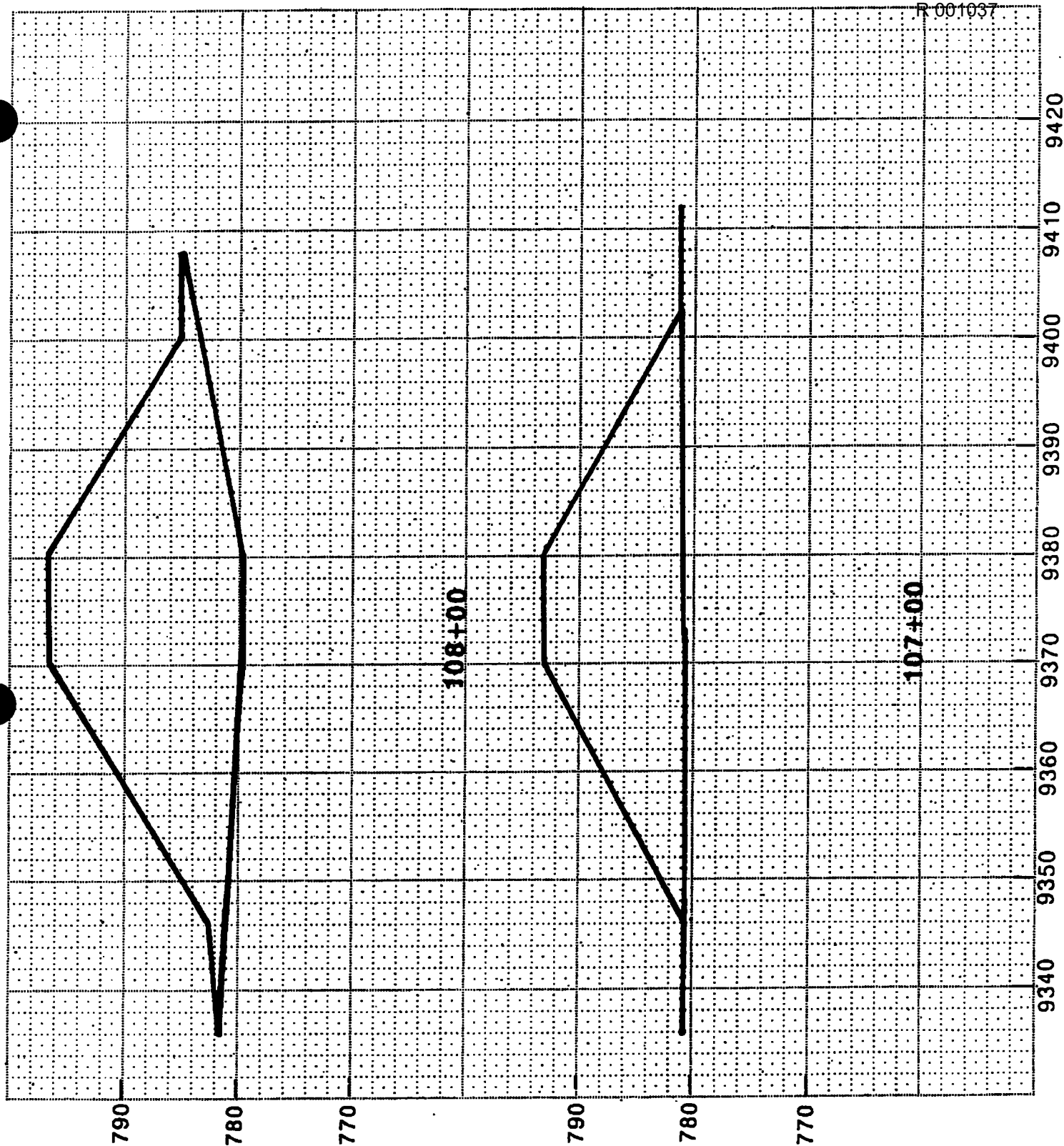
COMMENTS:

TOTAL = 382,134 CF

= 14,153 CY

APPENDIX D

CLAY DIVISION BERM CROSS-SECTIONS

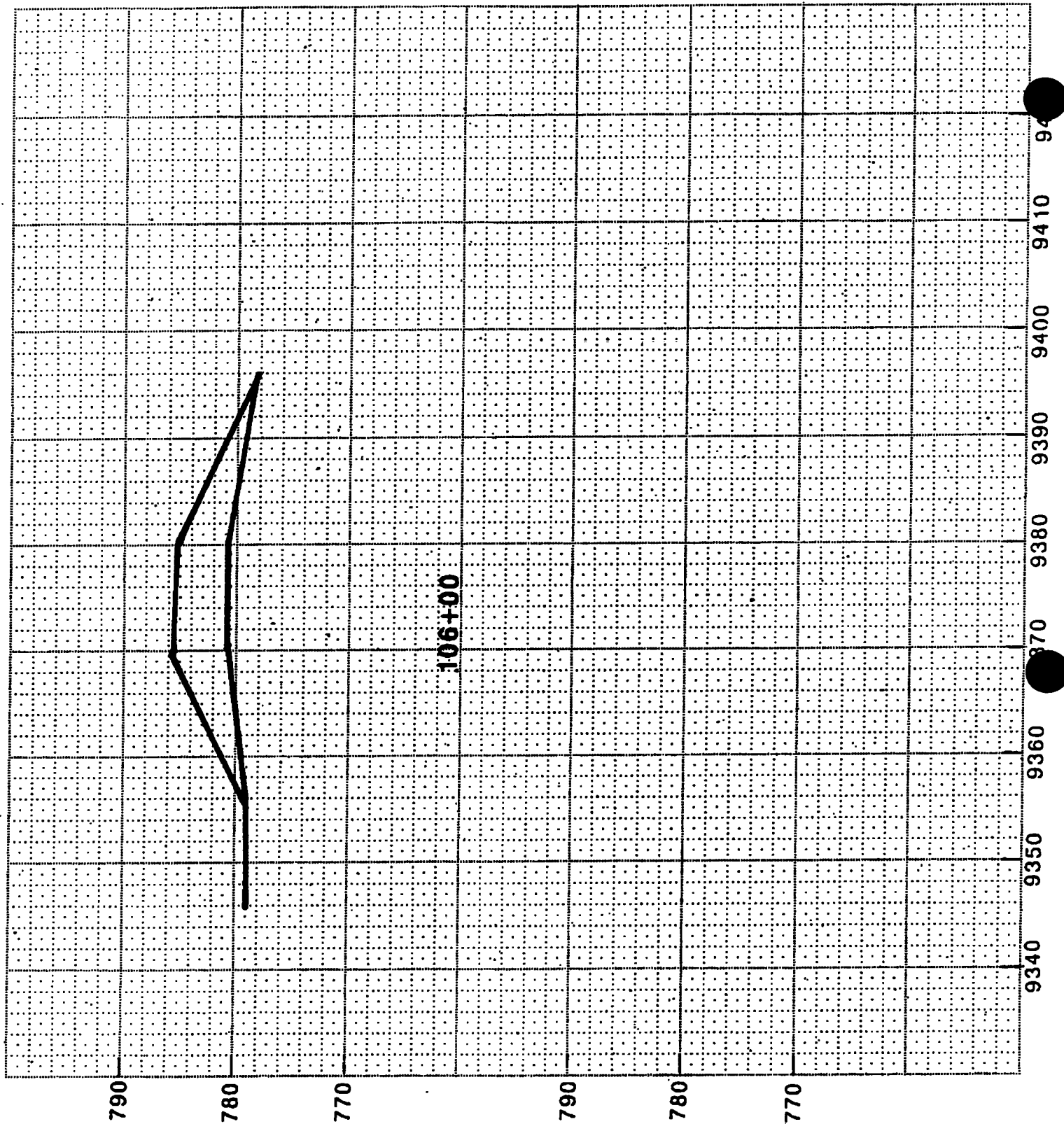


MAY, 1992

CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

19766.300

Donohue ENGINEERS
 ARCHITECTS
 SCIENTISTS

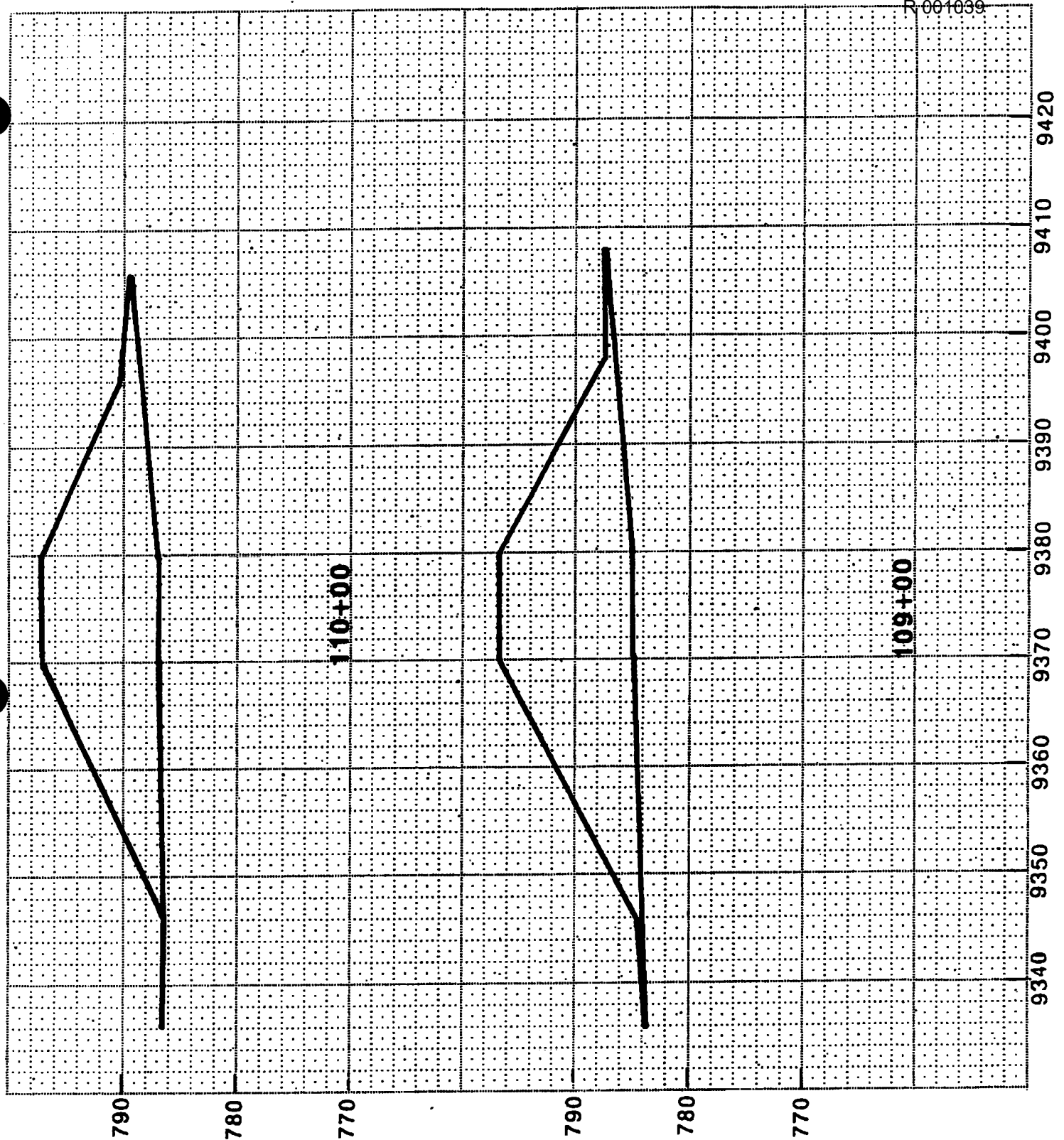


MAY, 1992

CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR, - CLAY DIVISION BERM
ZION, ILLINOIS

19766.300

Donohue ENGINEERS
ARCHITECTS
SCIENTISTS

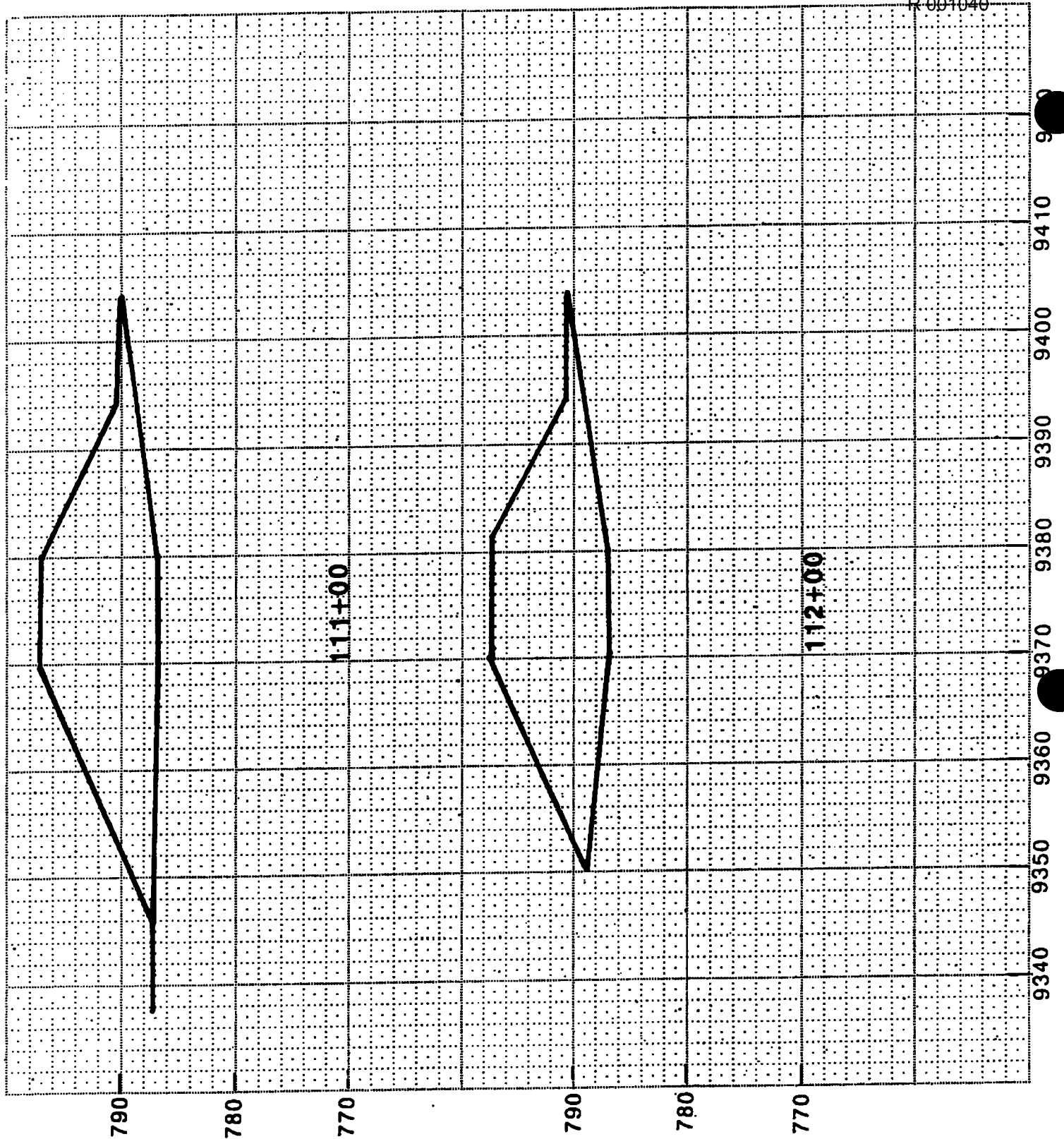


MAY, 1992

CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

19766 300

Donohue ENGINEERS
ARCHITECTS
SCIENTISTS

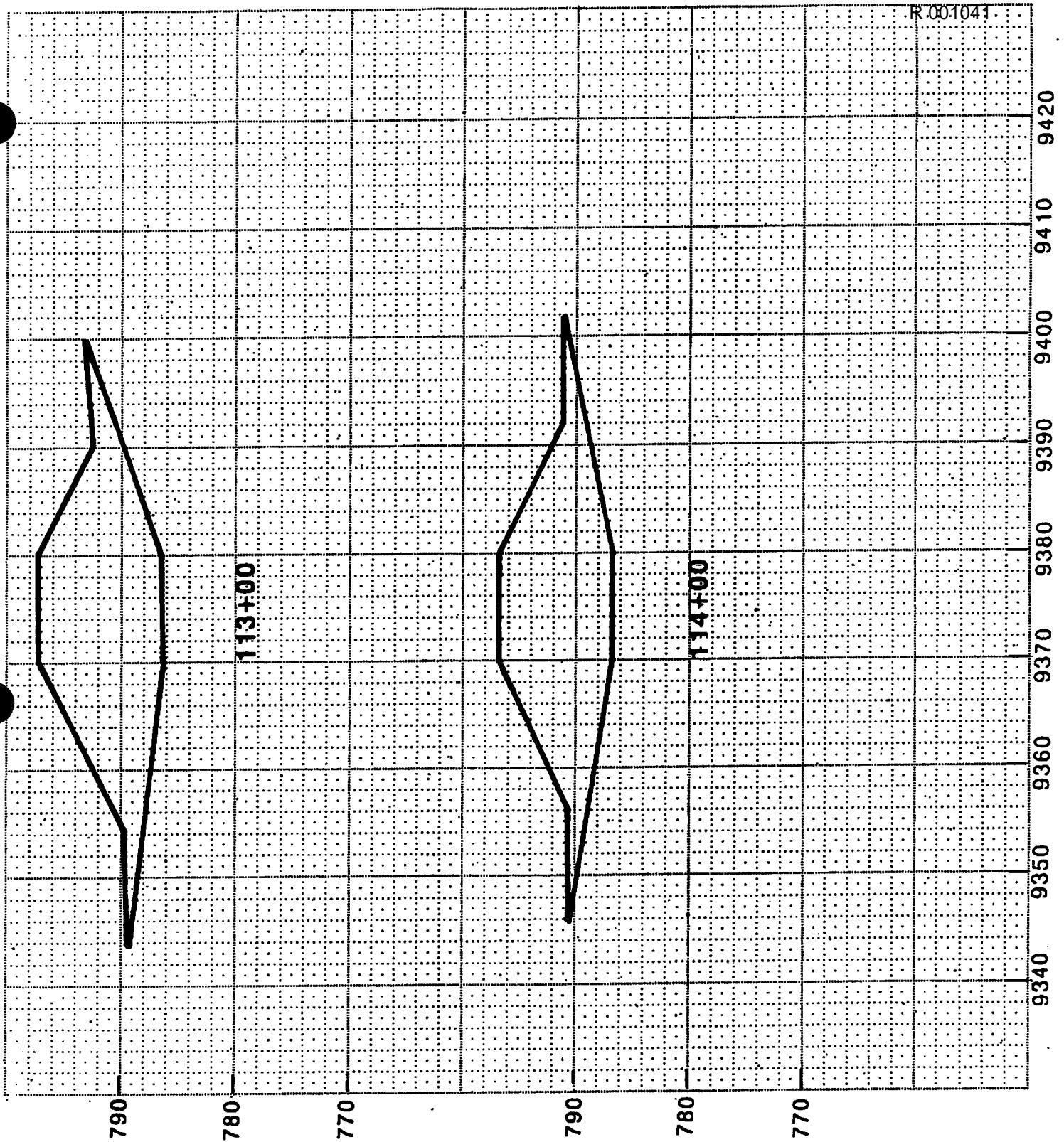


MAY, 1992

CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

19766 300

Donohue ENGINE
ARCHITECTS
SCIENTISTS

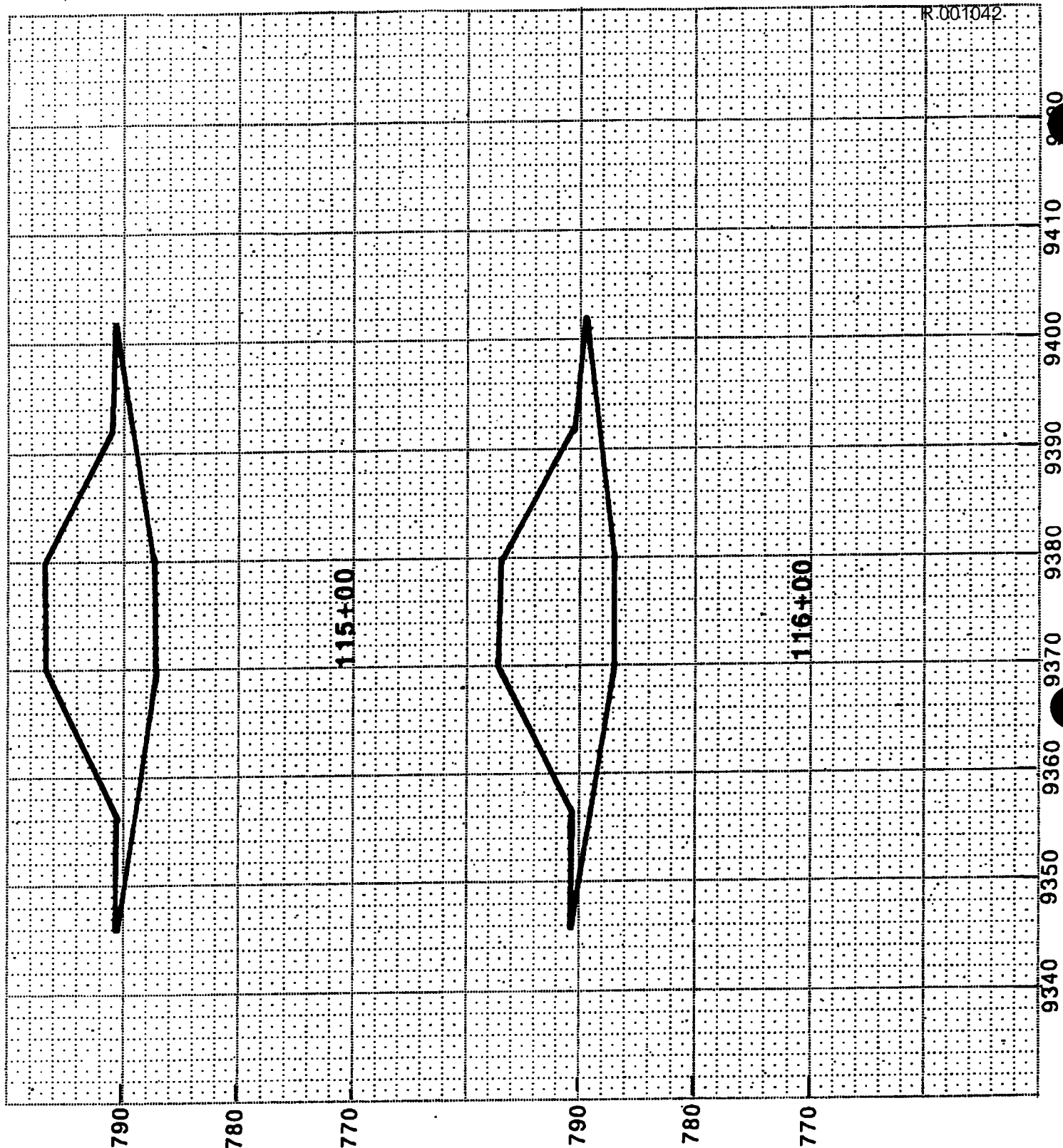


MAY, 1992

CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

19766 300

Donohue ENGINEERS
ARCHITECTS
SCIENTISTS



MAY, 1992

CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

19766 300

Donohue ENGINEERS
ARCHITECTS
SCIENTISTS

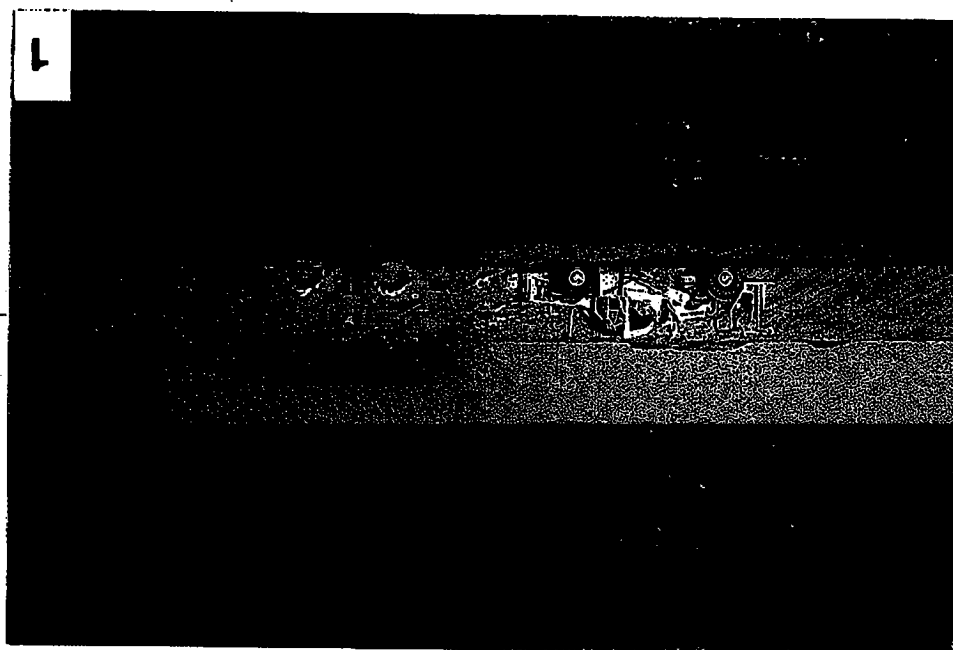
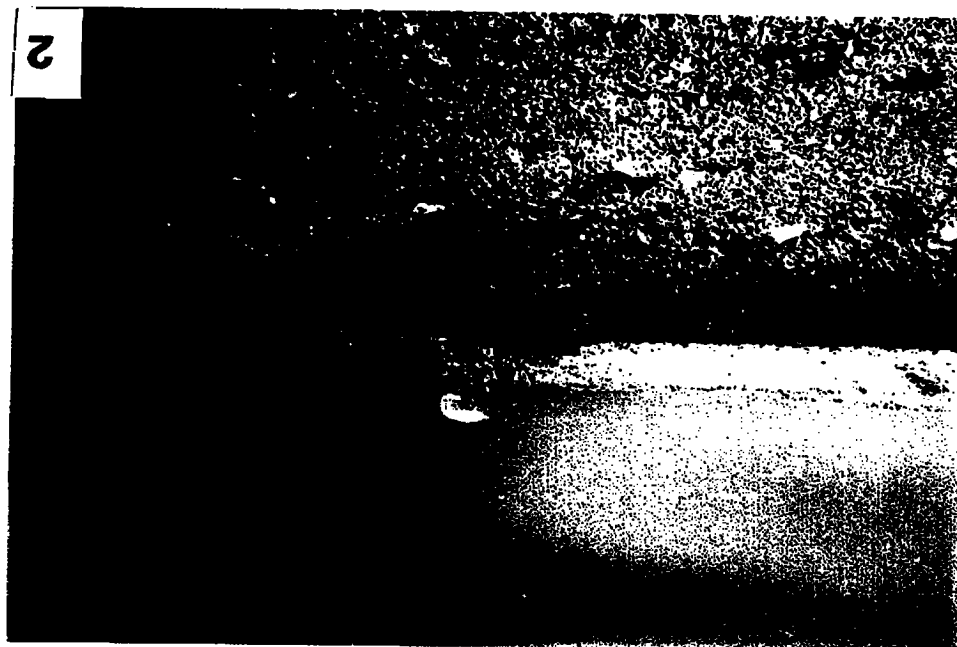
APPENDIX E
PHOTOGRAPHS

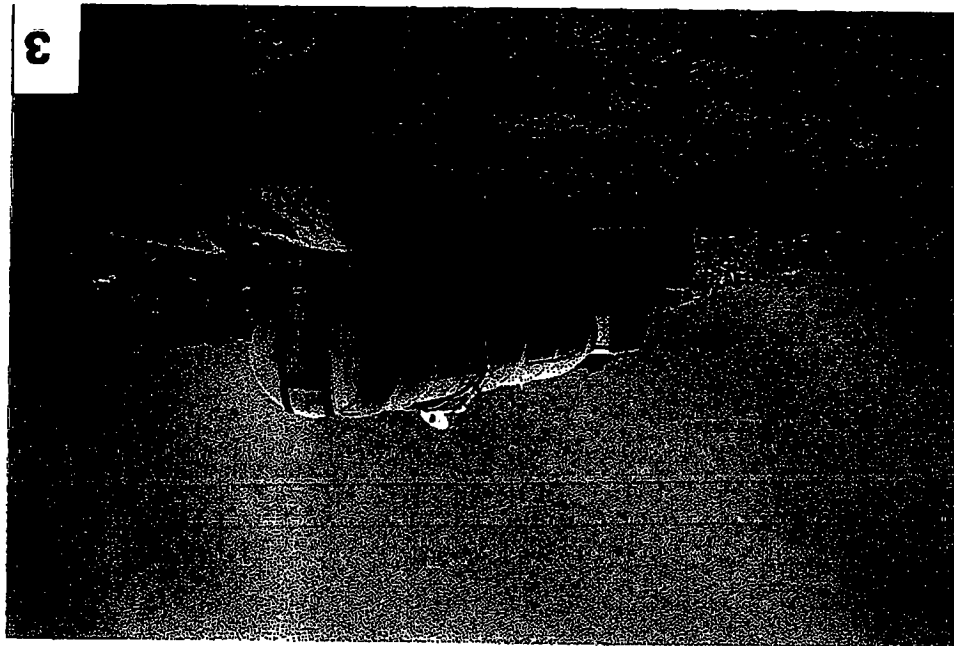
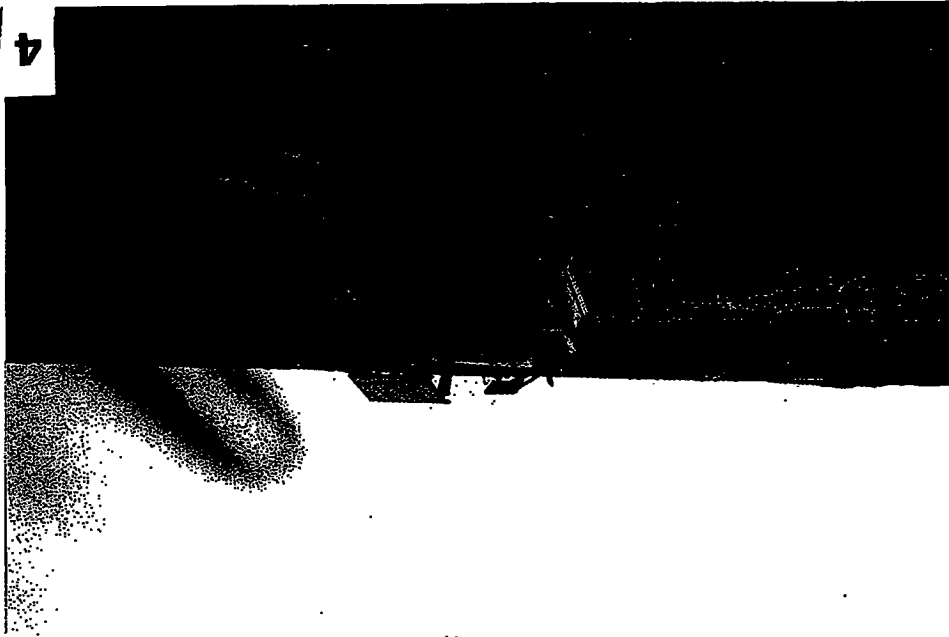
APPENDIX E

PHOTOGRAPHS

<u>Photograph No.</u>	<u>Description</u>
1	Placement and compaction of clay material at approximate Station 11500 North.
2	Compaction equipment; approximate Station 11000 North.
3	Adding moisture prior to placement of additional clay material.
4	Rough grading side slope of clay division berm.

RP/BFIWINTH/AB6





APPENDIX F

FIELD DENSITY TEST RESULTS

NUCLEAR DENSITY TESTS FOR
WINTHROP HARBOR
CLAY DIVISION BERM
ZION, ILLINOIS

DATE	TEST	RETEST	STATION	OFFSET	DESCRIPTION	ELEVATION	DEPTH OF PROBE	WET DENSITY PCF	DRY DENSITY PCF	MOISTURE PERCENT	PERCENT STANDARD PROCTOR	PERCENT COMPACT	
05/13/92	8.05		114+60	CL	BSC	790.0	12	124.8	108.9	15.9	14.6	113.8	95.7
05/14/92	9.04		116+90	5 RT	BSC	788.0	12	127.5	112.6	14.9	13.2	113.8	98.9
05/15/92	10.01		112+95	5 RT	BROWN	789.0	12	126.2	111.5	14.7	13.2	113.8	98.0
05/15/92	10.02		113+00	CL	BROWN	788.0	12	122.7	107.9	14.8	13.7	113.8	94.8
05/15/92	10.05		110+25	10	BROWN	788.0	12	129.2	115.1	14.1	12.3	120.6	95.4
05/16/92	11.01		109+00	CL	GSC	4.0	12	127.3	113.2	14.1	12.5	113.8	99.5
05/16/92	11.02		110+00	5 LT	GSC	3.0	12	131.9	116.5	15.4	13.2	113.8	102.4
05/16/92	11.03		113+00	CL	GSC	4.0	12	131.9	116.4	15.5	13.3	113.8	102.3
05/18/92	12.01		114+00	CL	GSC	5.0	12	140.6	127.2	13.4	10.5	113.8	111.8
05/18/92	12.02		113+00	5 LT	GSC	5.0	12	140.8	127.3	13.5	10.6	113.8	111.9
05/18/92	12.03		115+00	5 RT	GSC	4.0	12	140.8	124.8	16.0	12.8	113.8	109.7
05/18/92	12.04		108+00	CL	GSC	3.0	12	138.5	123.9	14.6	11.8	113.8	108.9
05/18/92	12.05		109+00	5 LT	GSC	2.0	12	140.8	125.7	15.1	12.0	113.8	110.5
05/18/92	12.06		115+00	5 LT	GSC	3.0	12	129.9	113.9	16.0	14.0	113.8	100.1
05/18/92	12.07		114+00	5 RT	GSC	3.0	12	140.2	123.3	16.9	13.7	113.8	108.3
05/18/92	12.08		112+00	5 RT	GSC	3.0	12	137.8	120.8	17.0	14.1	113.8	106.2
05/18/92	12.09		115+00	CL	GSC	2.0	12	140.2	123.1	17.1	13.9	113.8	108.2
05/18/92	12.10		116+00	R LT	GSC	3.0	12	137.8	121.1	16.7	13.8	113.8	106.4
05/19/92	13.01		113+00	CL	GSC	6.0	12	139.0	121.3	17.7	14.6	120.6	100.6
05/19/92	13.02		115+00	CL	GSC	6.0	12	138.5	120.5	18.0	14.9	120.6	99.9
05/19/92	13.04		116+00	5 RT	GSC	5.0	12	139.2	120.9	18.3	15.1	120.6	100.2
05/19/92	13.05		111+00	CL	GSC	4.0	12	139.2	121.3	17.9	14.8	120.6	100.6
05/19/92	13.06		109+00	5 LT	GSC	6.0	12	139.9	122.7	17.2	14.0	120.6	101.7
05/19/92	13.07		111+00	CL	GSC	6.0	12	140.5	123.9	16.6	13.4	120.6	102.7
05/20/92	14.01		108+00	CL	GSC	5.0	12	136.6	119.0	17.6	14.8	120.6	98.7
05/20/92	14.02		110+00	5 RT	GSC	7.0	12	139.0	121.2	17.8	14.7	120.6	100.5
05/20/92	14.03		111+00	CL	GSC	8.0	12	140.7	122.1	18.6	15.2	120.6	101.2
05/20/92	14.04		115+00	CL	GSC	7.0	12	137.1	118.7	18.4	15.5	120.6	98.4
05/20/92	14.05		111+00	CL	GSC	8.0	12	140.7	122.7	18.0	14.7	120.6	101.7
05/20/92	14.06		108+00	5 LT	GSC	7.0	12	137.8	118.0	19.8	16.8	120.6	97.8
05/20/92	14.07		109+00	CL	GSC	8.0	12	138.1	118.6	19.5	16.4	120.6	98.3
05/20/92	14.08		112+00	CL	GSC	9.0	12	138.0	119.0	19.0	16.0	120.6	98.7
05/20/92	14.09		113+00	CL	GSC	8.0	12	138.5	121.2	17.3	14.3	120.6	100.5
05/20/92	14.10		109+00	CL	GSC	10.0	12	131.9	117.4	14.5	12.4	120.6	97.3
05/20/92	14.11		110+00	CL	GSC	9.0	12	139.1	121.8	17.3	14.2	120.6	101.0
05/21/92	15.01		109+00	CL	GSC	10.0	12	139.1	122.0	17.1	14.0	120.6	101.2
05/21/92	15.02		109+00	5 RT	GSC	12.0	12	142.4	123.7	18.7	15.1	120.6	102.6
05/21/92	15.03		109+50	5 LT	GSC	11.0	12	139.2	120.8	18.4	15.2	120.6	100.2
05/21/92	15.04		114+00	CL	GSC	9.0	12	140.7	122.1	18.6	15.2	120.6	101.2
05/21/92	15.05		115+00	CL	GSC	8.0	12	140.0	121.0	19.0	15.7	120.6	100.3
05/21/92	15.06		116+00	CL	GSC	7.0	12	137.7	119.9	17.8	14.8	120.6	99.4
05/21/92	15.08		115+00	CL	GSC	10.0	12	140.0	121.9	18.1	14.8	120.6	101.1
05/21/92	15.09		116+00	CL	GSC	9.0	12	139.2	120.5	18.7	15.5	120.6	99.9
06/01/92	17.01		106+00	CL	GSC	1.0	12	126.9	110.2	16.7	15.2	113.8	96.8
06/01/92	17.02		107+00	5 RT	GSC	2.0	12	127.9	113.4	14.5	12.8	113.8	99.6
06/01/92	17.03		106+50	2.5 RT	GSC	3.0	12	125.5	107.4	18.1	16.9	113.8	94.4
06/01/92	17.04	17.03	106+50	2.5 RT	GSC	3.0	12	129.4	114.4	15.0	13.1	113.8	100.5
06/01/92	17.05		107+00	2.5 LT	GSC	4.0	12	126.0	109.8	16.2	14.8	113.8	96.5

NUCLEAR DENSITY TESTS FOR
WINTHROP HARBOR
CLAY DIVISION BERM
ZION, ILLINOIS

DATE	TEST	RETEST	STATION	OFFSET	DESCRIPTION	ELEVATION	DEPTH OF	WET	DRY	MOISTURE	PERCENT	STANDARD	PERCENT
							PROBE	DENSITY	DENSITY				
								PCF	PCF				
06/01/92	17.06		106+00	CL	GSC	5.0	12	126.2	109.6	16.6	15.1	113.8	96.3
06/01/92	17.07		107+00	2.5 LT	GSC	6.0	12	127.1	113.5	13.6	12.0	113.8	99.7
06/01/92	17.08		106+75	2.5 RT	GSC	7.0	12	122.4	102.2	20.2	19.8	113.8	89.8
06/01/92	17.09	17.08	106+75	2.5 RT	GSC	7.0	12	125.3	109.5	15.8	14.4	113.8	96.2
06/01/92	17.10		106+00	5 RT	GSC	8.0	12	126.7	109.6	17.1	15.6	113.8	96.3
06/01/92	17.11		107+00	5 LT	GSC	9.0	12	127.4	112.3	15.1	13.4	113.8	98.7
06/01/92	17.12		106+00	CL	GSC	10.0	12	126.5	110.4	16.1	14.6	113.8	97.0
06/02/92	18.01		107+00	5 RT	GSC	11.0	12	125.3	108.1	17.2	15.9	113.8	95.0
06/02/92	18.02		106+50	5 LT	GSC	12.0	12	123.9	107.5	16.4	15.3	113.8	94.5
06/02/92	18.03	18.02	106+50	5 LT	GSC	12.0	12	125.0	108.4	16.6	15.3	113.8	95.3
06/02/92	18.04		107+50	5 LT	GSC	13.0	12	123.0	104.9	18.1	17.3	113.8	92.2
06/02/92	18.05	18.04	107+50	5 LT	GSC	13.0	12	125.8	108.1	17.7	16.4	113.8	95.0
06/02/92	18.06		106+00	5 RT	GSC	14.0	12	127.6	109.9	17.7	16.1	113.8	96.6
06/02/92	18.07		107+00	CL	GSC	15.0	12	125.1	110.1	15.0	13.6	113.8	96.7
06/02/92	18.08		106+00	5 LT	GSC	16.0	12	124.5	105.1	19.4	18.5	113.8	92.4
06/02/92	18.09	18.08	106+00	5 LT	GSC	16.0	12	127.7	111.1	16.6	14.9	113.8	97.6
06/02/92	18.10		107+00	5 RT	GSC	17.0	12	121.7	103.4	18.3	17.7	113.8	90.9
06/02/92	18.11	18.10	107+00	5 RT	GSC	17.0	12	131.4	114.9	16.5	14.4	113.8	101.0

APPENDIX G
LABORATORY SOIL TEST RESULTS



MILWAUKEE, WI
LOS ANGELES, CA
WASHINGTON, D.C.

GILES ENGINEERING ASSOCIATES, INC.

GEOTECHNICAL, GEO-ENVIRONMENTAL
AND CONSTRUCTION MATERIALS CONSULTANTS

N8 W22350 JOHNSON ROAD, SUITE A1 / WAUKESHA, WI 53186
414-544-0118, FAX: 414-549-5868

June 24, 1992

SEC Donohue, Inc.
4738 North 40th Street
Sheboygan, WI

Attention: Mr. Jim Michaels

Subject: QA/QC Laboratory Testing Services
BF1-Zion Facility
701 Green Bay Road
Zion, Illinois
GEA Project No. 1M-920436

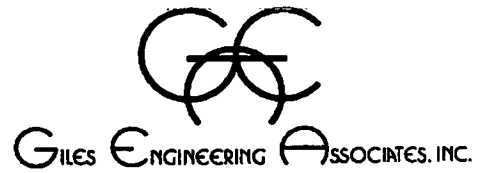
Dear Mr. Michaels:

In accordance with your request, Quality Assurance/Quality Control Laboratory Testing has been performed on landfill materials samples submitted by your personnel from the above referenced project. The purpose of the landfill (clay) testing was to determine pertinent engineering characteristics of the landfill materials for verification of project specification compliance.

The QA/QC Laboratory Testing has been performed in accordance with applicable ASTM Standards. Laboratory Testing for the materials submitted for this project consisted of performing the following tests.

1. Moisture Content (ASTM D2216).
2. Dry Density (ASTM D2732).
3. Grain Size Analysis (ASTM D422).
4. Atterberg Limits (ASTM D4318).
5. Standard Proctor (ASTM D698).
6. Falling Head Permeability (Flexible Wall).
7. USCS Soil Classification (ASTM D2487).

The test results are summarized on the following test data summary report and the individual test reports are appended.



BF1-Zion Facility
Zion, Illinois
GEA Project No. 1M-920436
Page 2

GEA appreciates the opportunity to be of continued service on this project. If there are any questions in regards to this letter or if GEA can be of further service please do not hesitate to call at any time.

Very truly yours,

GILES ENGINEERING ASSOCIATES, INC.

Shelley Hildebrandt, Geologist
Senior Lab Assistant

Don Mich, Geologist
Laboratory Manager

Daniel B. Anderson, P.E.
Const. Materials Dept. Manager

Enclosures: Test Data Summary Reports
Report of Grain Size Analysis
Report of Proctor Test
Report of Permeability Test

JUN92\20/BU136/PAO
M436L.RFT

G.E.A. Project No. 1M-920436

R 001053

SUMMARY OF QA/QC LABORATORY TEST RESULTS

ZION RDF

G.E.A. Project No. 1M-920436

SAMPLE ID NO.	LOCATION			IN SITU		GRAINSIZE		ATTERBERG LIMITS		USCS CLASS.	MOISTURE-DENSITY RELATION.		PERMEABILITY (cm/s)
				MOISTURE CONTENT (%)	DRY UNIT WEIGHT (p.c.f.)	P200 (%)	CLAY (0.002mm) (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)		MAXIMUM DRY DENSITY (p.c.f.)	OPTIMUM MOISTURE (%)	
6U	N116+50	E93+75	Lift 9	13.3	---	---	---	---	---	---	----	----	2 x 10E-8
8R	N109+50	E93+75	Lift 10	15.8	---	84.2	33.9	27	14	CL	122.8	11.7	----
9R	Borrow Site			19.8	---	68.0	24.0	26	11	CL	118.8	13.5	----
10R	Borrow Pit	N119+00	Lift 11	15.6	115.8*	88.6	35.9	26	13	CL	121.9	12.5	7 x 10E-9
8U	N121+00		Lift 11	14.8	118.5	87.4	33.9	26	12	CL	----	----	7 x 10E-9
7U	N117+00	E93+75	Lift 15	14.6	121.0	85.4	35.8	28	14	CL	----	----	1 x 10E-8
9U	N122+00		Lift 18	14.6	119.8	85.4	34.2	25	12	CL	----	----	1 x 10E-8
* Remolded Density													
High				19.8	125.7	88.6	38.0	29	14		122.5	14.0	9 x 10E-9
Low				11.1	114.4	68.0	24.0	25	11		113.8	11.7	1 x 10E-8
Mean				15.5	120.1	78.3	31.0	27	12.5		118.2	12.9	9.5 x 10E-9

R 001034

The graph displays the grain size distribution of a sample. The y-axis represents the percentage of material finer than a given grain size, ranging from 0 to 100. The x-axis represents the grain size in millimeters on a logarithmic scale, ranging from 200 mm down to 0.00 mm. The curve starts at 100% finer for grain sizes down to approximately 0.075 mm (No. 20 sieve) and then drops sharply, reaching about 28% finer at 0.0075 mm (No. 20 sieve).

Grain Size (mm)	Percent Finer (%)
200	100
100	100
50	100
25	100
12.5	100
6.3	100
3.15	100
1.6	100
0.85	100
0.425	100
0.25	100
0.15	100
0.075	100
0.0475	95
0.025	85
0.015	75
0.0075	65
0.00475	55
0.0025	45
0.0015	35
0.00075	28

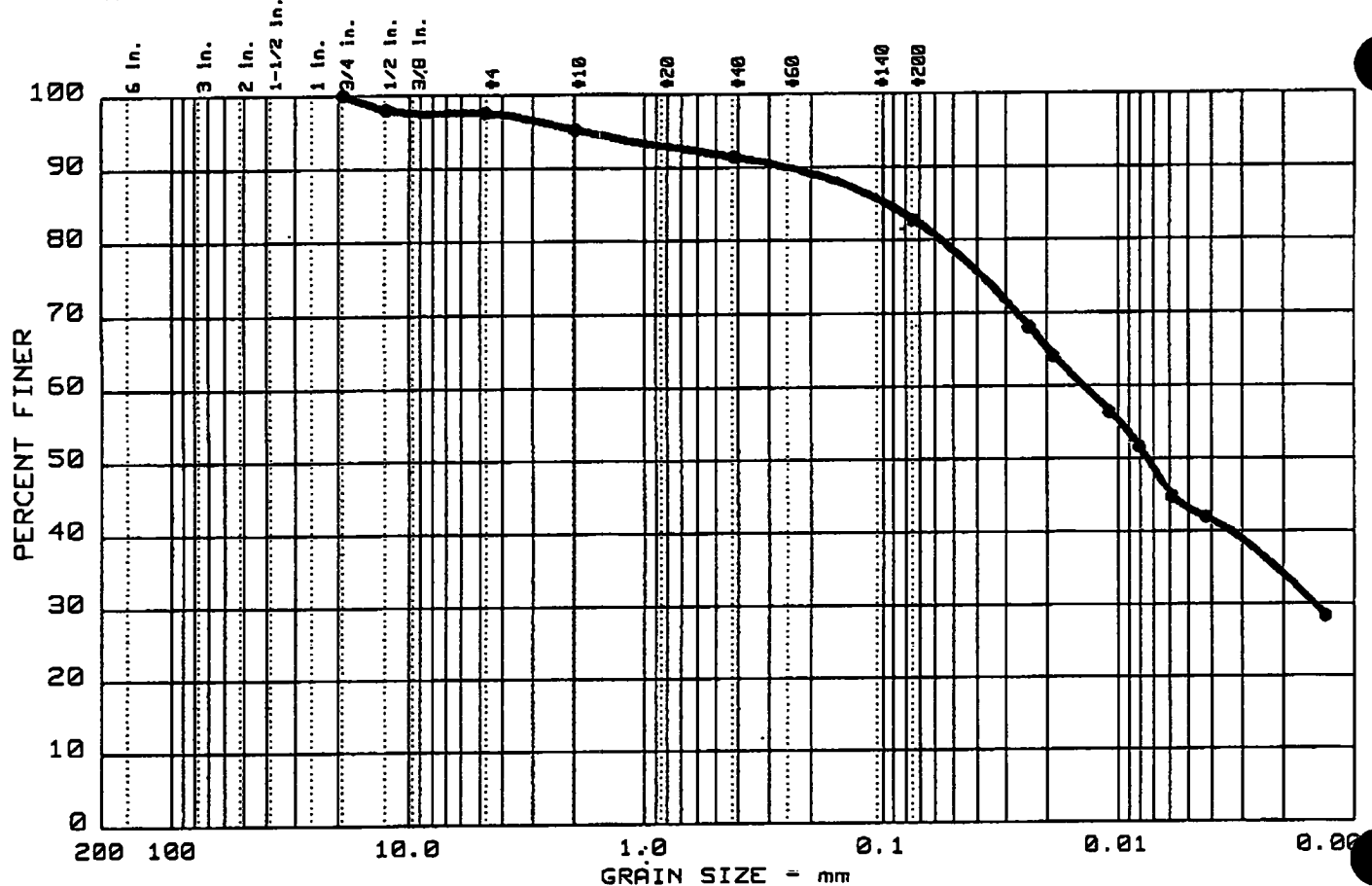
Project No.: 1M-920436 Project: BFI-Zion Facility Client: BFI Waste Systems	Remarks:
Date: 5-21-92	
Giles Engineering Assoc., Inc.	Figure No.

The graph shows a grain size distribution curve for a soil sample. The y-axis represents 'PERCENT FINER' from 0 to 100. The x-axis represents 'GRAIN SIZE - mm' on a logarithmic scale from 200 to 0.001. The curve starts at 100% finer for 200 mm and decreases as grain size decreases, passing through approximately 90% finer at 4.75 mm, 50% finer at 0.075 mm, and ending at approximately 30% finer at 0.001 mm.

Grain Size (mm)	Percent Finer (%)
200	100
100	100
4.75	90
0.85	75
0.425	60
0.25	50
0.075	30
0.001	30

Project No.: 1M-920436 Project: BFI-Zion Facility Client: BFI Waste Systems	Remarks:
Date: 5-21-92	
Giles Engineering Assoc., Inc.	Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



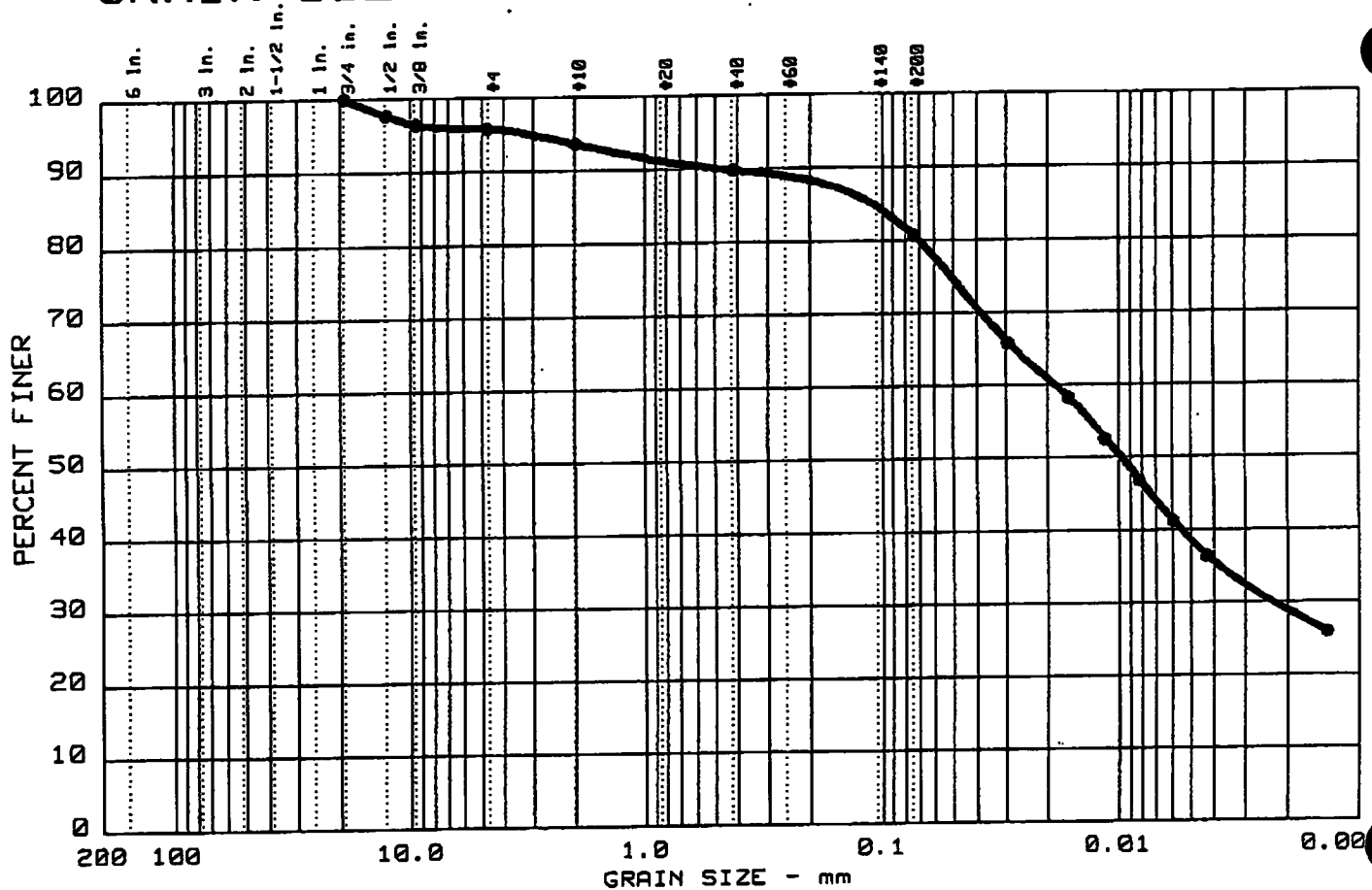
Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
● 3	0.0	2.3	14.9	48.6	34.2	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
● 12.9	29	15	14.0	2.7		0.001			

MATERIAL DESCRIPTION	SAMPLE LOCATION
● Gray-Brown Silty Clay with Sand	● 3-R

Project No.: 1M-920436 Project: BFI-Zion Facility Client: BFI Waste Systems Date: 5-21-92 Giles Engineering Assoc., Inc.	Remarks: Figure No.
---	--

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
● 5	0.0	4.2	15.1	51.8	28.9	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
● 13.4	26	12	14.0	2.7		0.002			

MATERIAL DESCRIPTION	SAMPLE LOCATION
● Gray-Brown Silty Clay with Sand	● 4-R

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

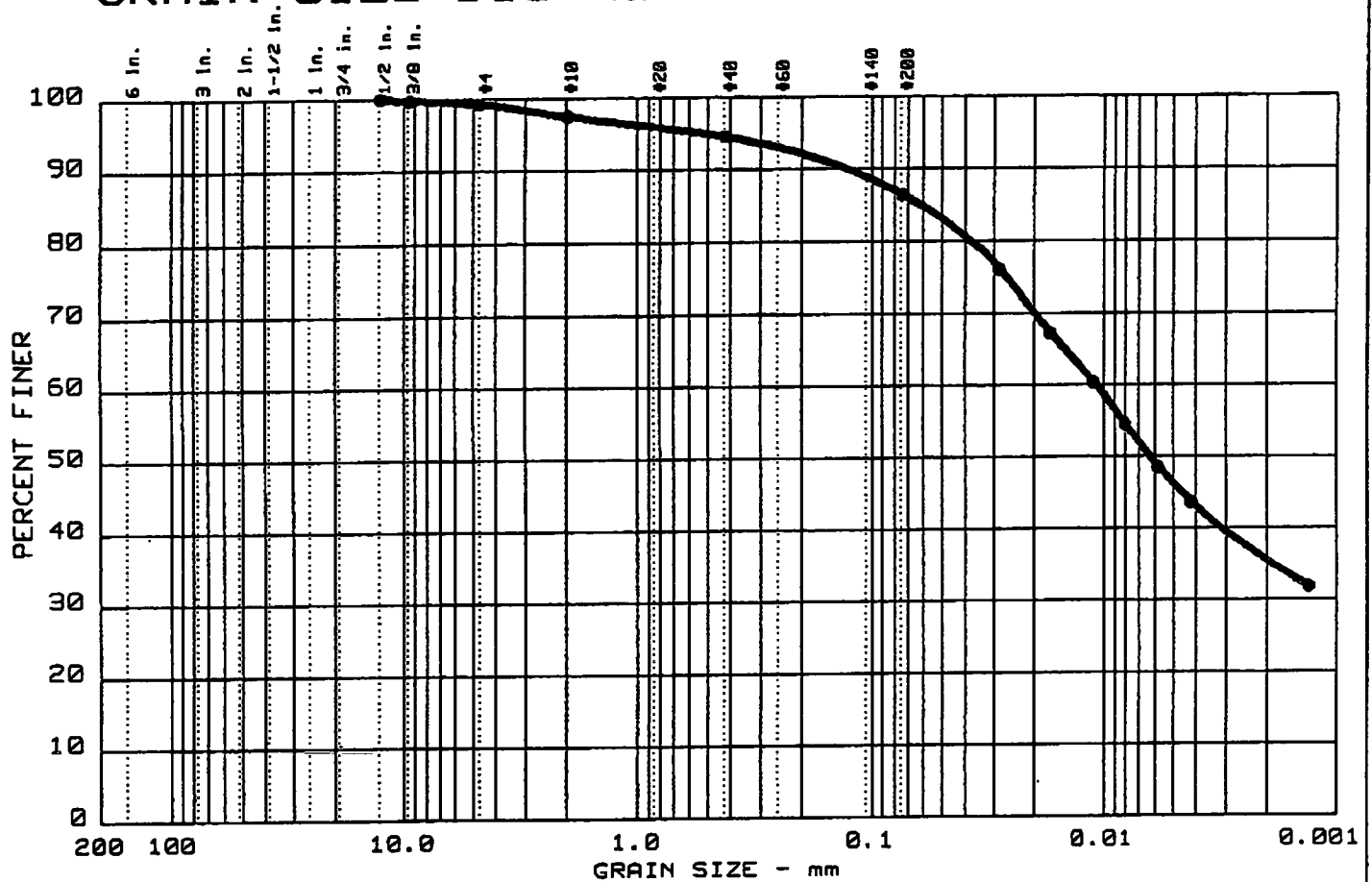
Date: 5-21-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
• 3	0.0	0.7	12.8	50.9	35.6	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
• 15.2	26	14	12.0	2.7					

MATERIAL DESCRIPTION	SAMPLE LOCATION
• Gray Silty Clay	• Sample No. 5-R

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

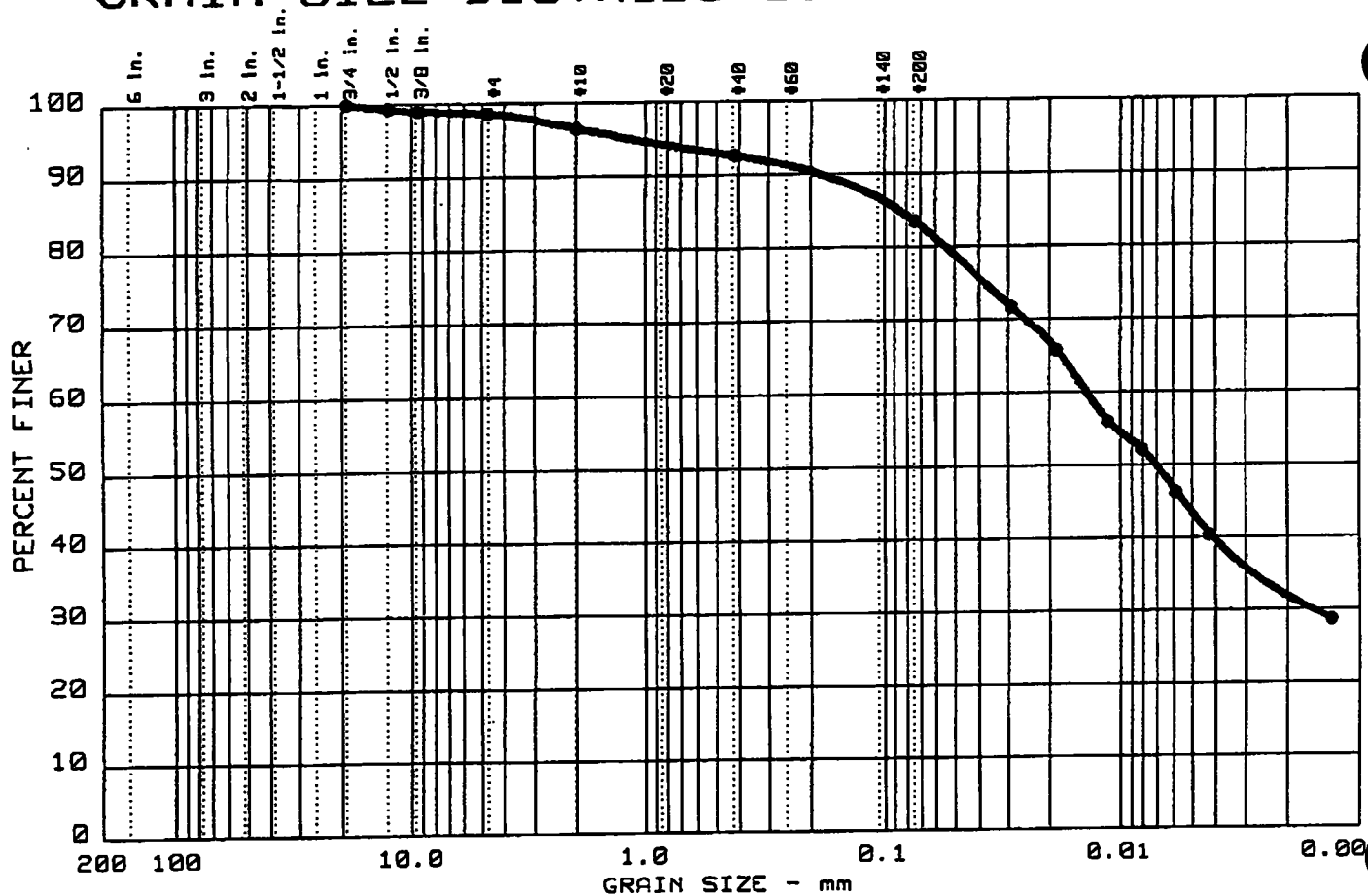
Date: 6-8-92

Giles Engineering Assoc., Inc.

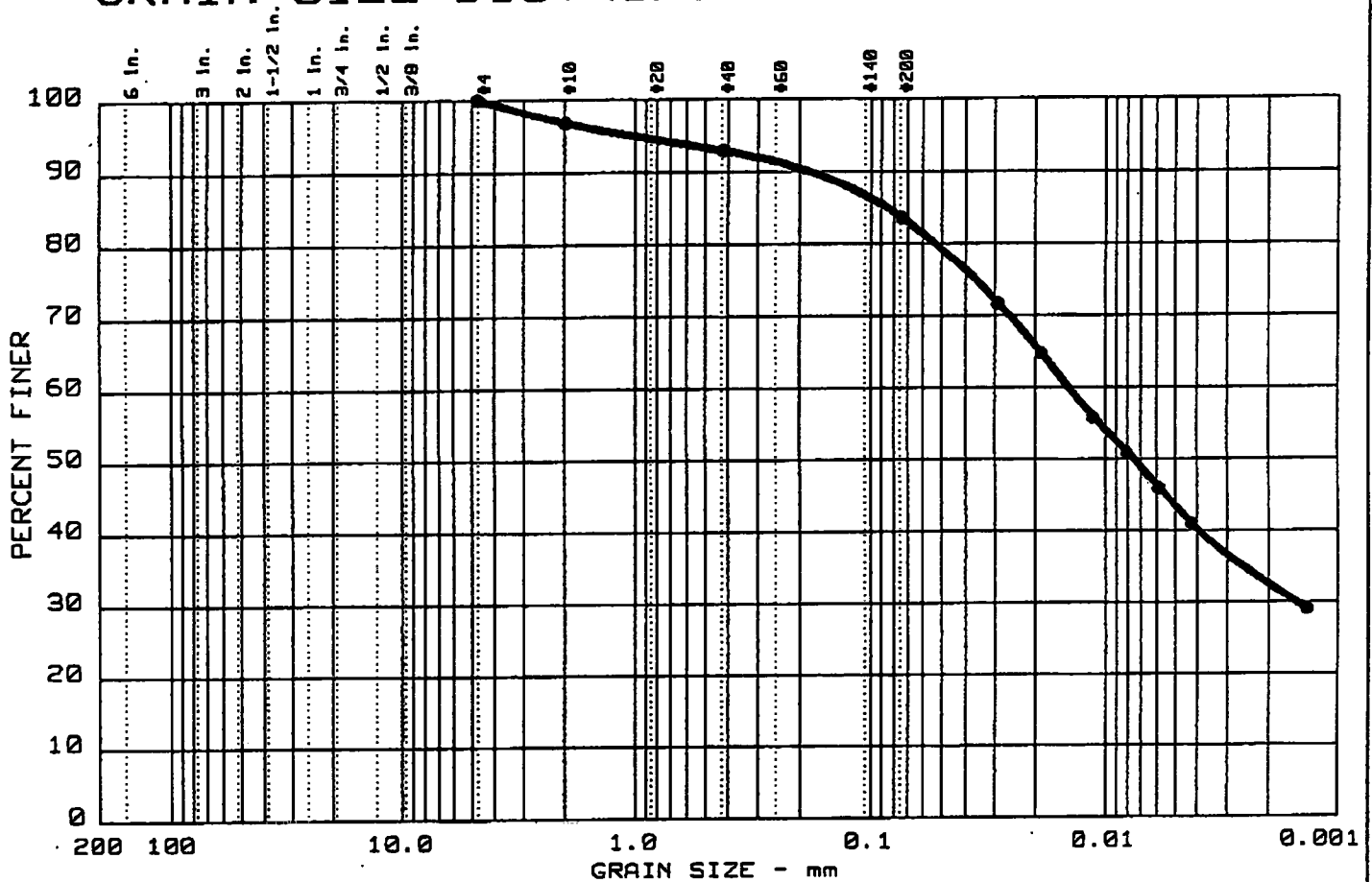
Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
● 6	0.0	0.0	16.3	51.1	32.6	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
● 15.8	26	13	13.0	2.7		0.001			

MATERIAL DESCRIPTION	SAMPLE LOCATION
● Gray-Brown Silty Clay with Sand	● Sample No. 7-R

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

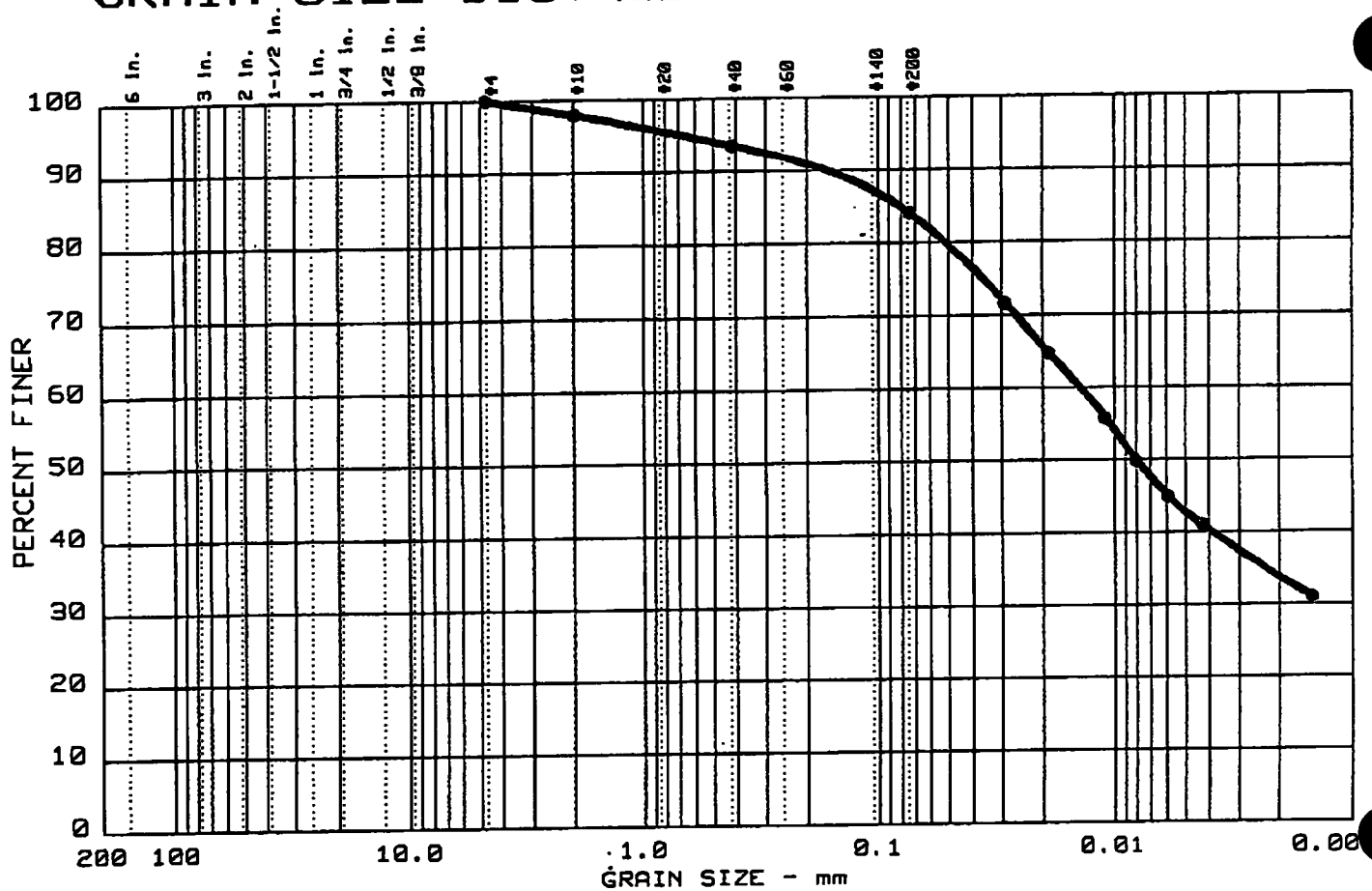
Date: 6-8-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
● 5	0.0	0.0	15.8	50.3	33.9	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
● 15.8	27	13	14.0	2.7					

MATERIAL DESCRIPTION	SAMPLE LOCATION
● Gray Silty Clay with Sand	● Sample No. 8-R

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

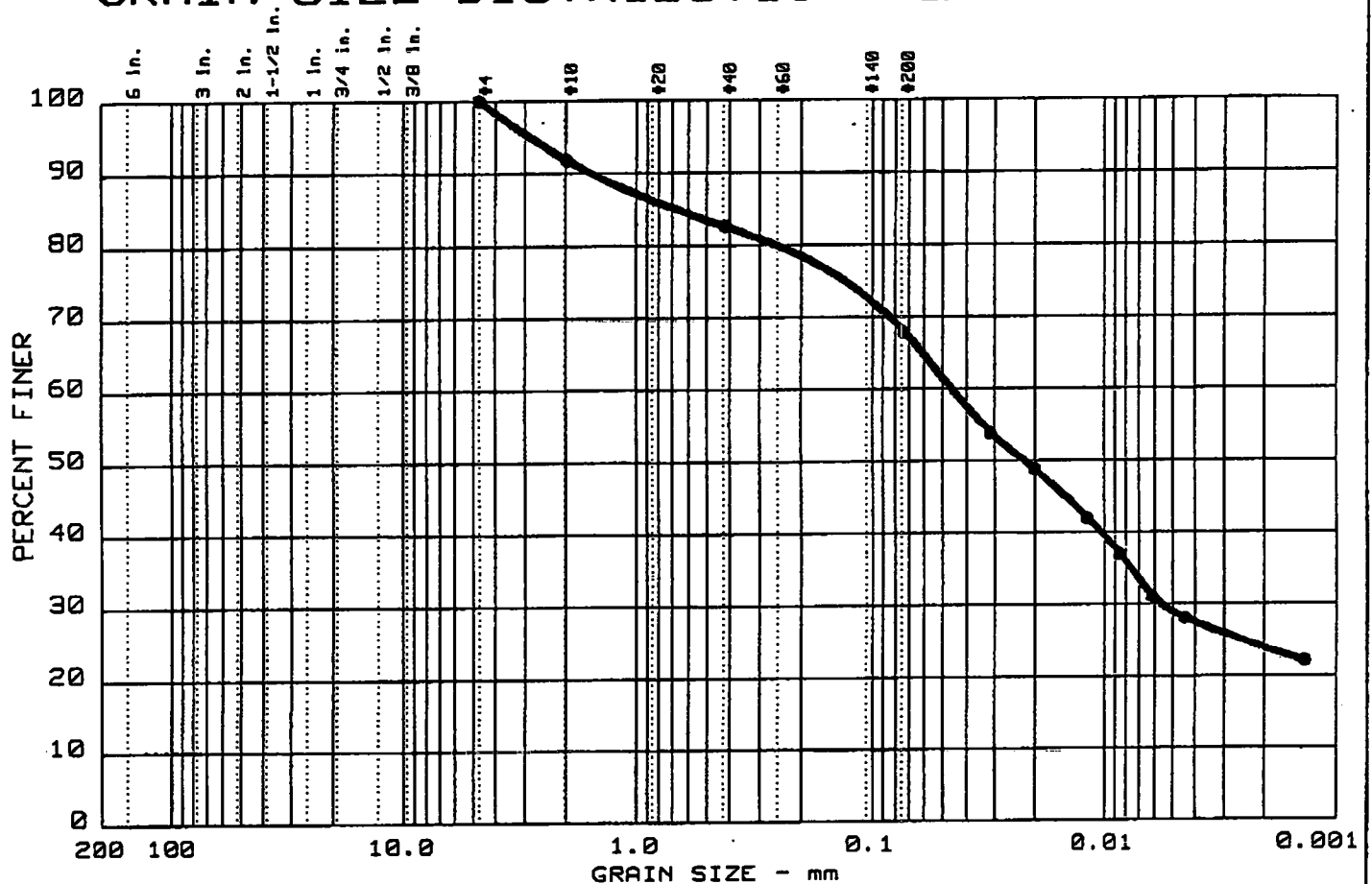
Date: 6-8-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
● 2	0.0	0.0	32.0	44.0	24.0	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
● 19.8	26	15	11.0	2.7		0.005			

MATERIAL DESCRIPTION	SAMPLE LOCATION
● Yellow-Brown Silty Clay with Sand	● Sample No. 9-R

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

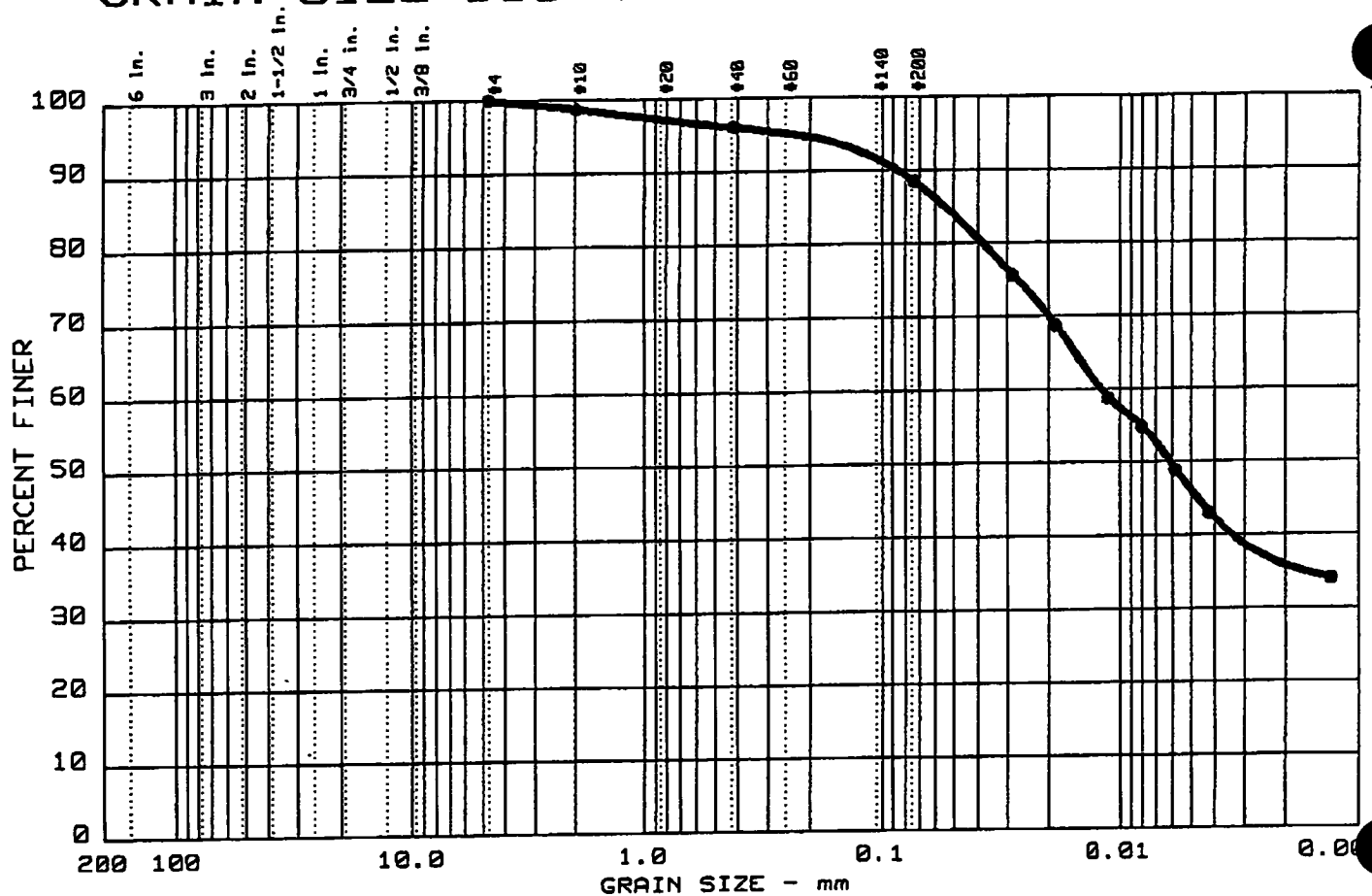
Date: 6-15-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
● 1	0.0	0.0	11.4	52.7	35.9	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
● 15.6	26	13	13.0	2.7					

MATERIAL DESCRIPTION	SAMPLE LOCATION
● Gray-Brown Silty Clay	● Sample No. 10-R

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems Inc.

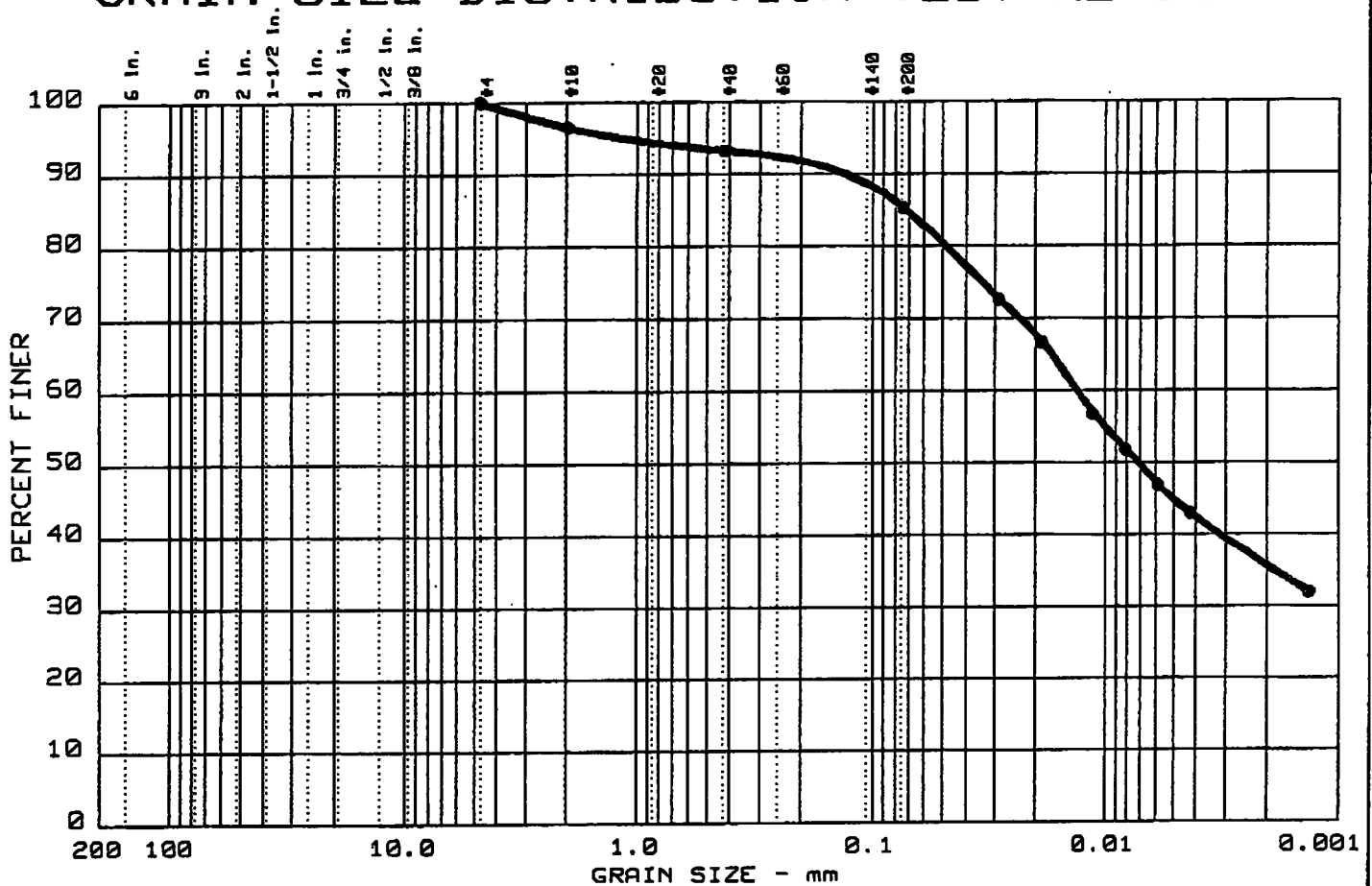
Date: 6-19-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
● 3	0.0	0.0	14.6	49.6	35.8	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
● 14.6	28	14	14.0	2.7					

MATERIAL DESCRIPTION	SAMPLE LOCATION
● Gray-Brown Silty Clay	● Sample No. 7-U

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

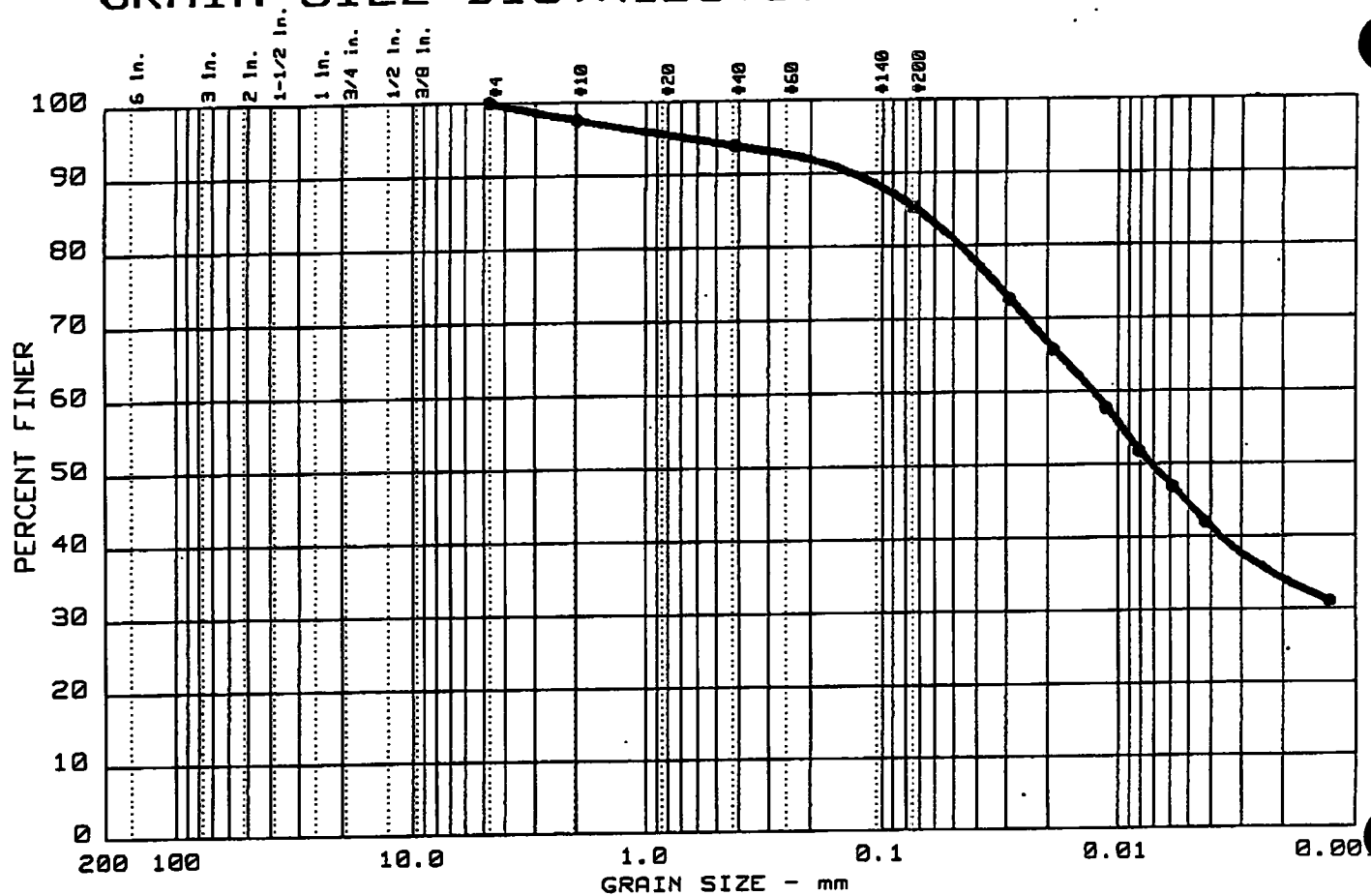
Date: 6-15-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
● 3	0.0	0.0	14.6	51.2	34.2	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
● 14.6	25	13	12.0	2.7					

MATERIAL DESCRIPTION	SAMPLE LOCATION
● Gray-Brown Silty Clay	● Sample No. 9-U

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems Inc.

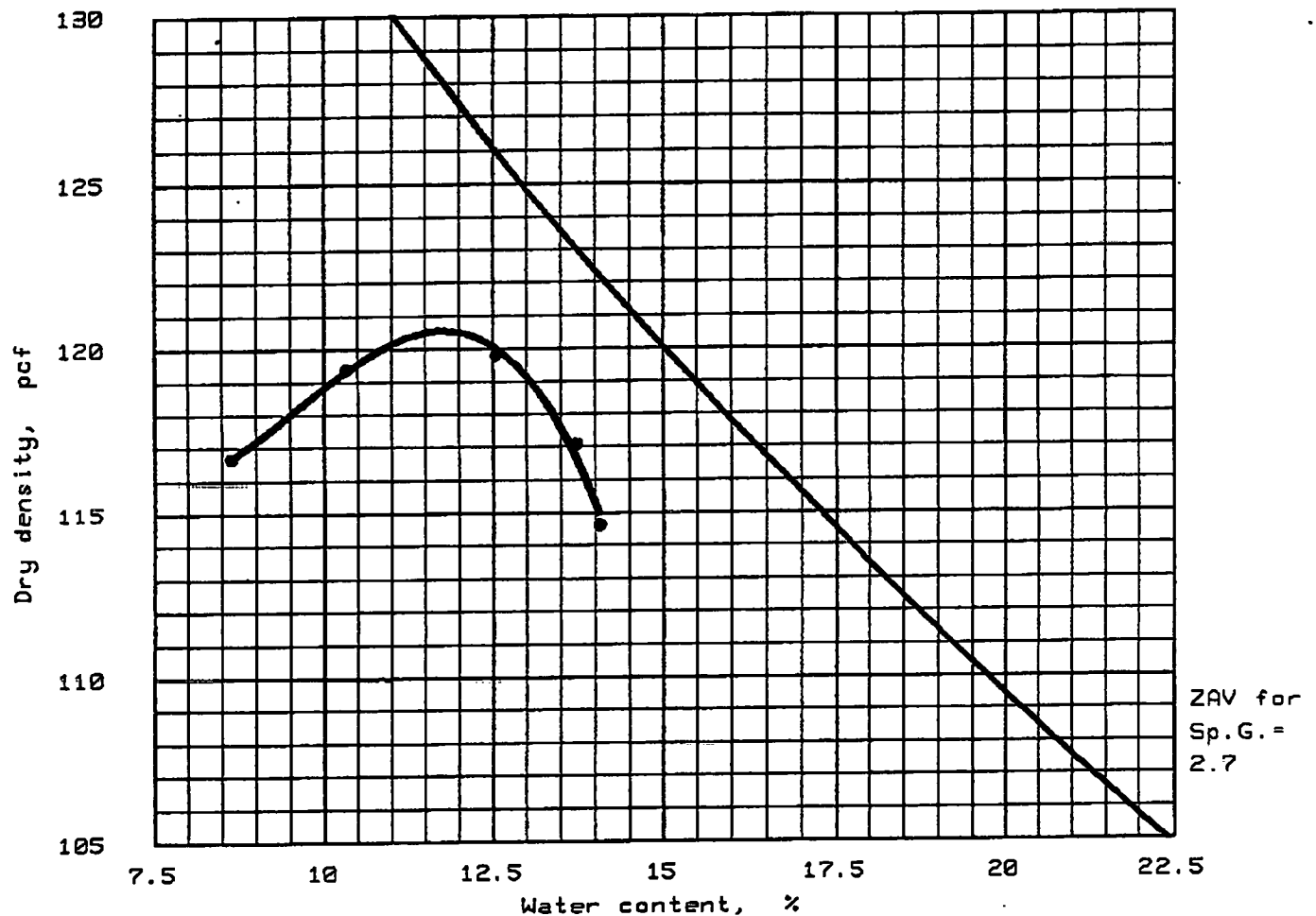
Date: 6-19-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 120.6 pcf

Optimum moisture = 11.7 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
	CL		15.1 %	2.7				

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay

1R Cell 1

Project No.: 1M-920436

Project: BFI-Zion Facility

Client: BFI Waste Systems

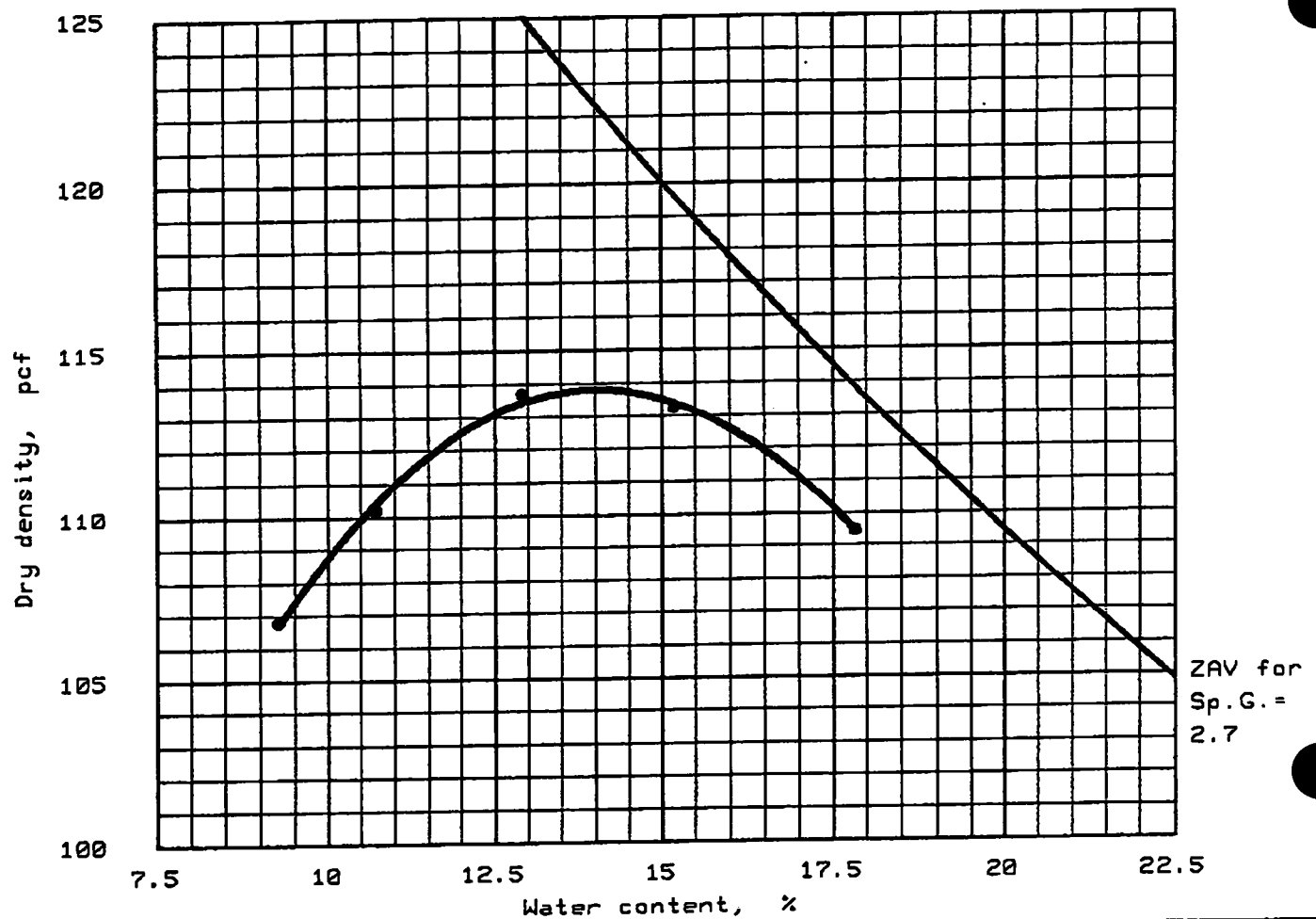
Date: 5-1-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 113.8 pcf

Optimum moisture = 14.0 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
	CL		11.7 %	2.7				

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay

2R Cell 2

Project No.: 1M-920436

Project: BFI-Zlon Facility

Client: BFI Waste Systems

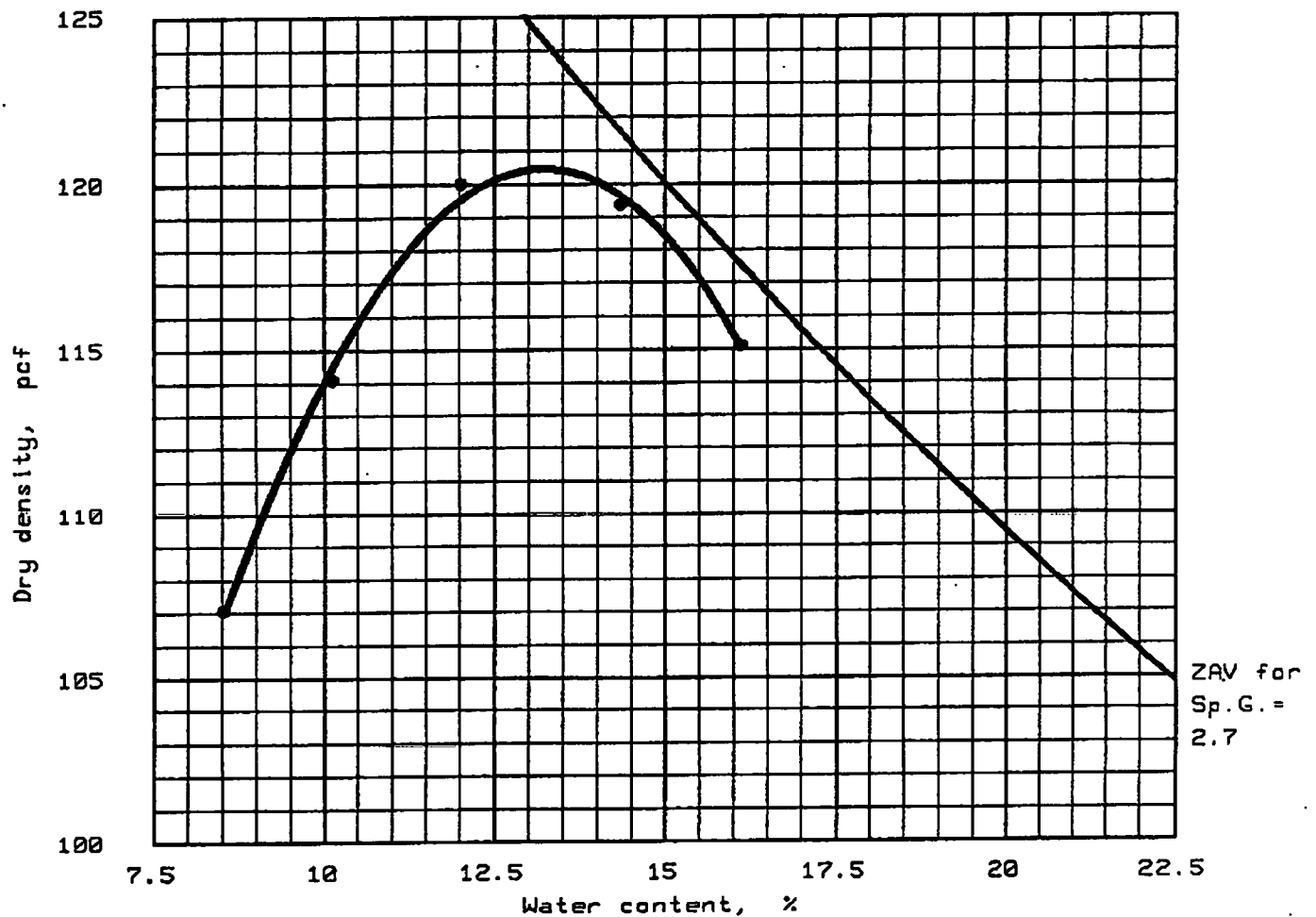
Date: 5-1-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 120.5 pcf

Optimum moisture = 13.2 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
	CL		15.4 %	2.7	29	14	2.3	82.8

MATERIAL DESCRIPTION

Gray-Brown Silty Clay
with Sand

SAMPLE LOCATION

3-R 117+00 East Edge

Project No.: 1M-920436

Project: BFI-Zion Facility

Client: BFI Waste Systems

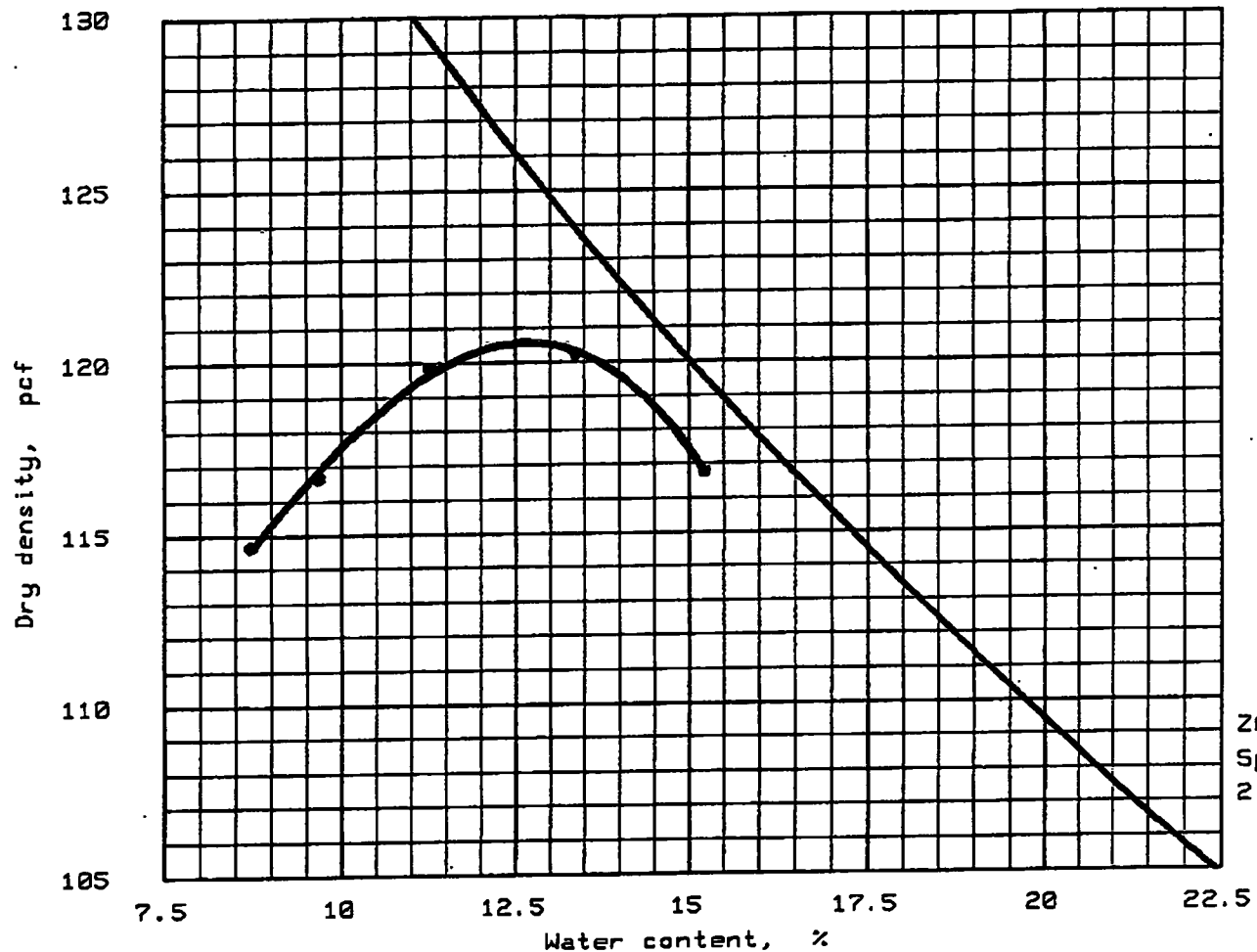
Date: 5-22-1992

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



ZAV for
Sp.G. =
2.7

"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 120.6 pcf

Optimum moisture = 12.7 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
SR	CL		15.2 %	2.7	26	12	0.7 %	86.5 %

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay with Sand

N116+00 E93+75 Lift 4

Project No.: 1M-920436
Project: BFI-Zion Facility
Client: BFI Waste Systems

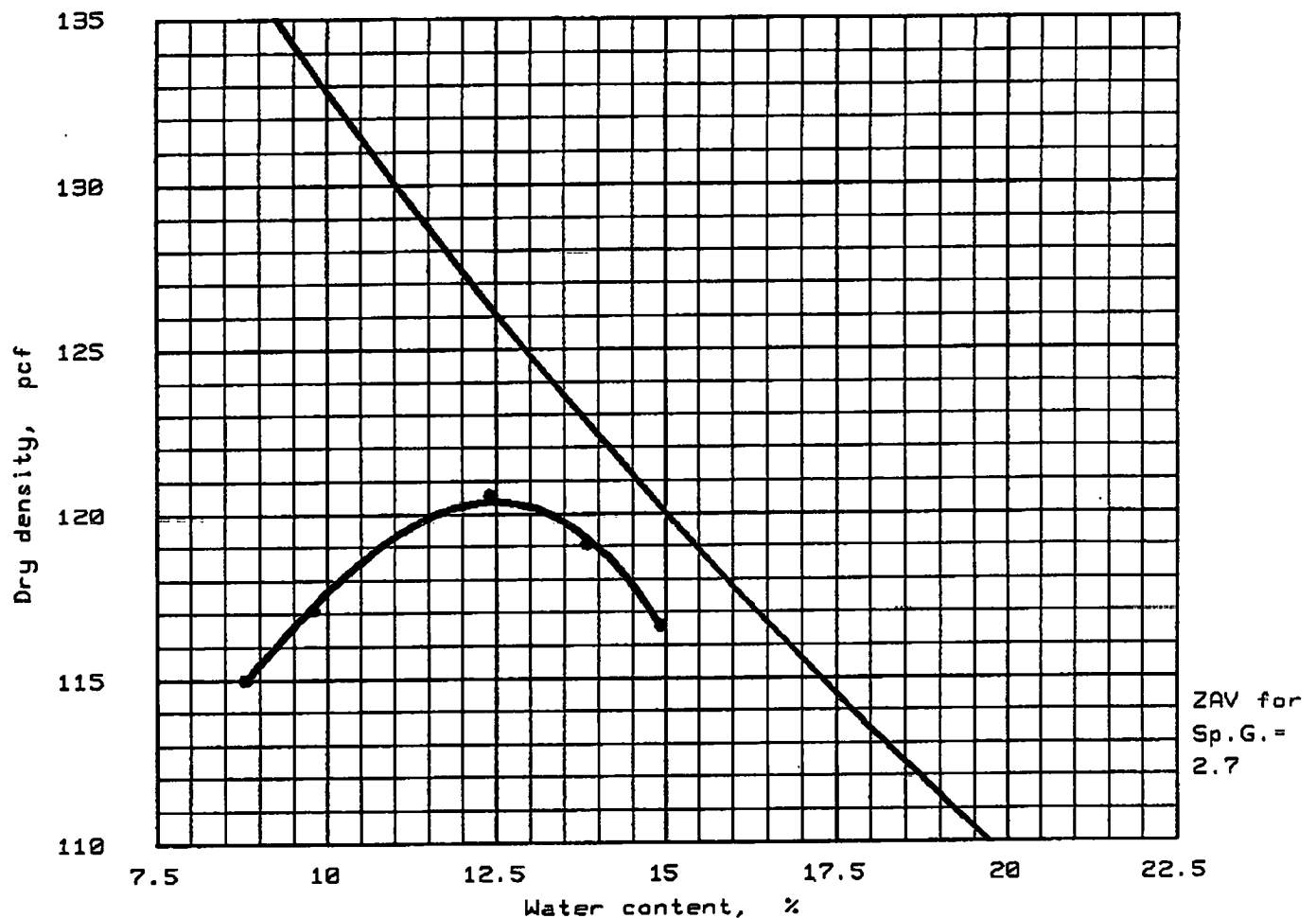
Date: 6-16-1992

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 120.4 pcf

Optimum moisture = 12.4 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
6-R	CL		14.3 %	2.7	25	12	1.3	83.6

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

N112+00N E93 + 75 Lift 6
Sample No. 6R

Project No.: 1M-920436

Project: BFI-Zion Facility

Client: BFI Waste Systems

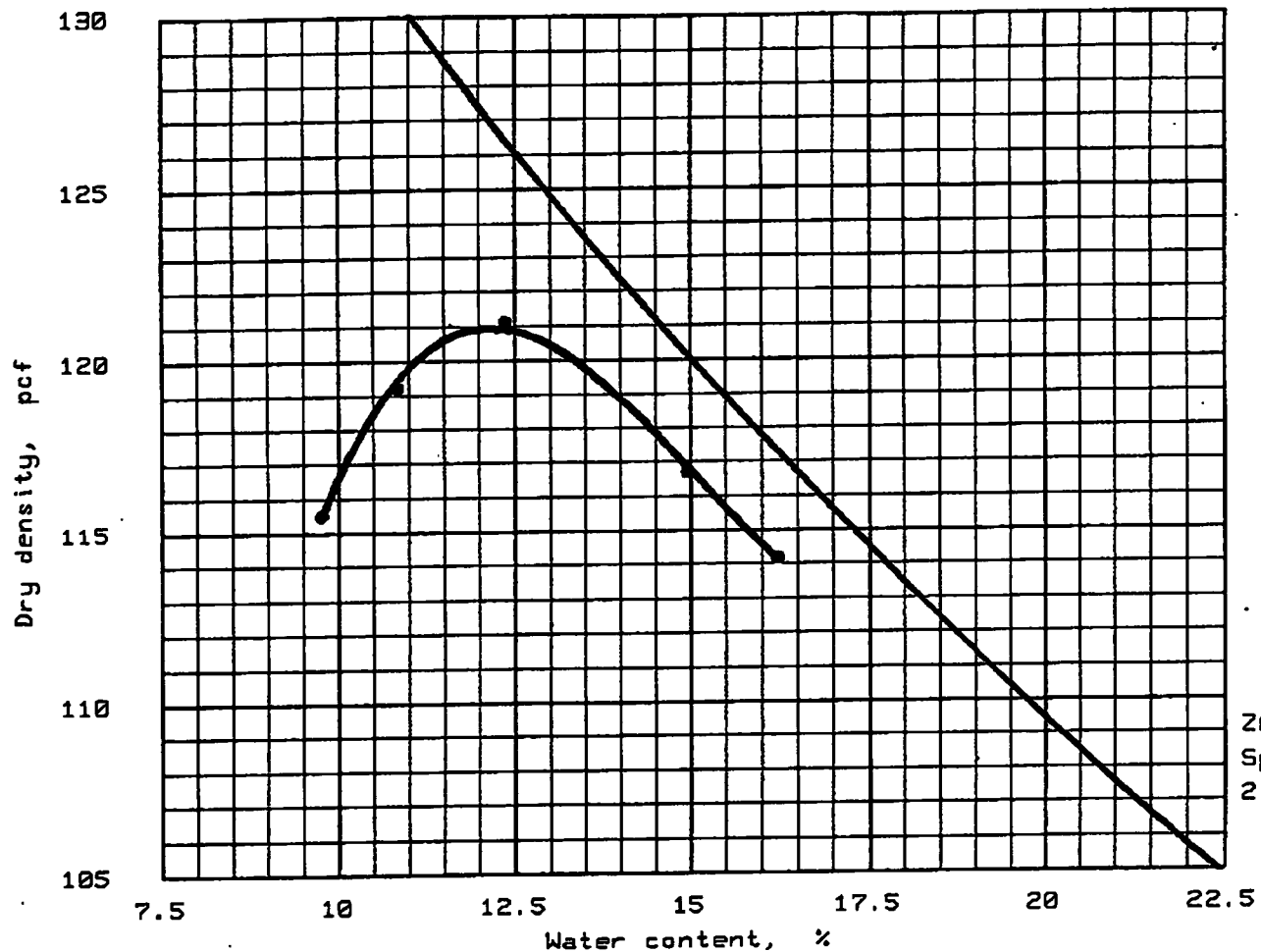
Date: 5-29-1992

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



ZAV for
Sp.G. =
2.7

"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 121.0 pcf

Optimum moisture = 12.1 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
7-R	CL		15.8 %	2.7	26	13	0.0	83.7

MATERIAL DESCRIPTION

Gray-Brown Silty Clay

SAMPLE LOCATION

N116+50 E93+75
Sample No. 7R

Project No.: 1M-920436
Project: BFI-Zion Facility
Client: BFI Waste Systems

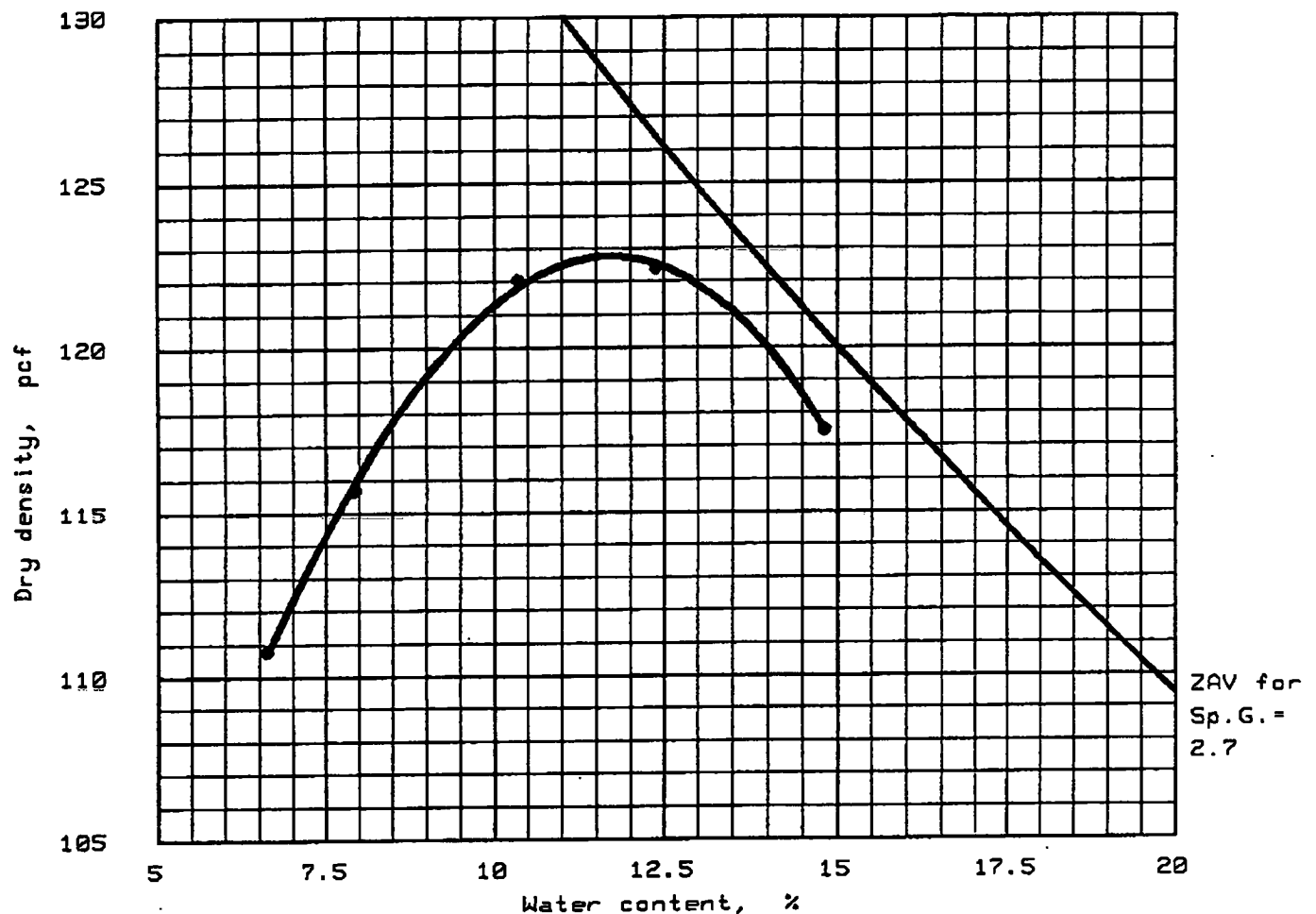
Date: 5-29-1992

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 122.8 pcf

Optimum moisture = 11.7 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
B-R	CL		15.8 %	2.7	27	14	0.0 %	84.2 %

MATERIAL DESCRIPTION

Gray-Brown Silty Clay
with Sand

SAMPLE LOCATION

N109+50 E93+75 Lift 10
Sample No. 8-R

Project No.: 1M-920436
Project: BFI-Zion Facility
Client: BFI Waste Systems

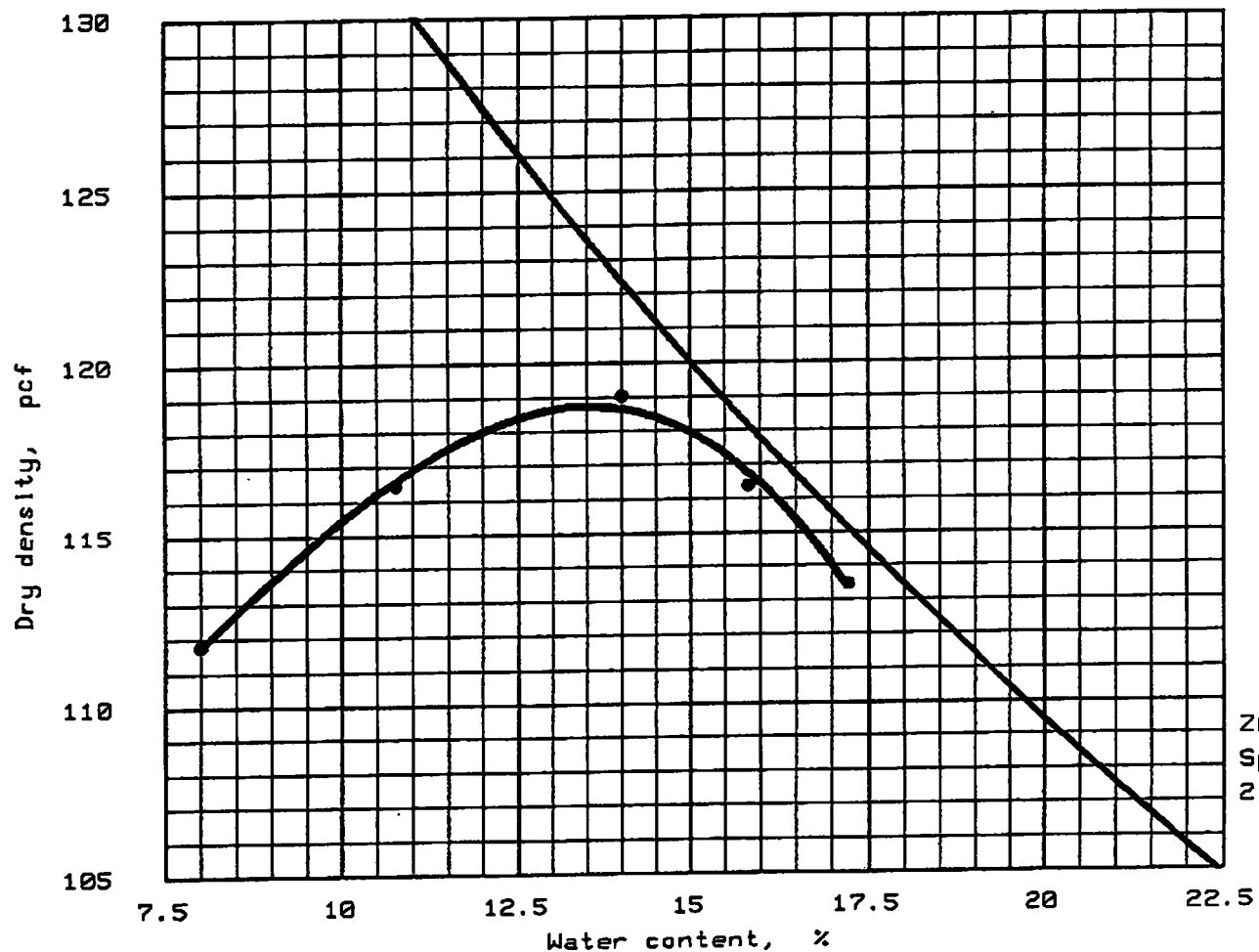
Date: 6-09-1992

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



ZAV for
Sp.G. =
2.7

"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 118.8 pcf

Optimum moisture = 13.5 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
9R	CL		19.8 %	2.7	26	11	0.0 %	68.0 %

MATERIAL DESCRIPTION

Gray Silty Clay with Sand

SAMPLE LOCATION

Barrow Site

Project No.: 1M-920436
Project: BFI-Zion Facility
Client: BFI Waste Systems

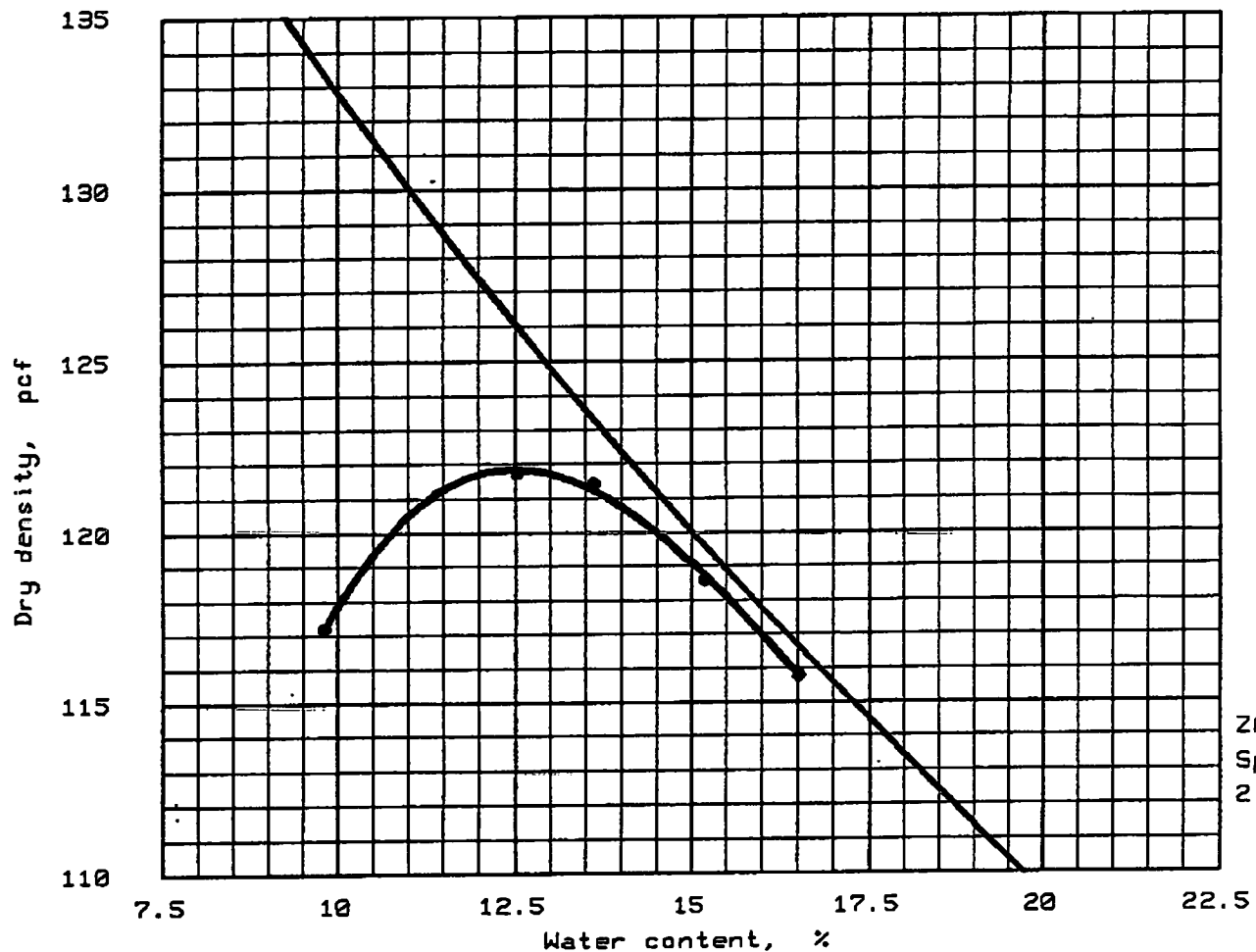
Date: 6-16-1992

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



ZAV for
Sp.G. =
2.7

"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 121.9 pcf

Optimum moisture = 12.5 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
10-R	CL		15.6 %	2.7	26	13	0.0 %	88.6 %

MATERIAL DESCRIPTION

Gray Silty Clay with Sand

SAMPLE LOCATION

N119+00 Lift 11
Borrow Pit

Project No.: 1M-920436

Project: BFI-Zion Facility

Client: BFI Waste Systems Inc.

Date: 6-19-1992

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.6	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.92
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 5-20, 5-22	TIME (T) (min)	BURETTE CHANGE lower	upper	FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T[0.0006L/A \cdot H]$
5:10	245	0.4	0.3	0.35	$5.4 \times 10E-9$
7:50	880	1.3	1.3	1.3	$5.6 \times 10E-9$
1:10	320	0.4	0.5	0.45	$5.3 \times 10E-9$
4:40	210	0.3	0.3	0.3	$5.4 \times 10E-9$
7:10	870	1.3	1.3	1.3	$5.7 \times 10E-9$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 5 \times 10E-9$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
13.0	122.7	84.1	30.9	28	15	13	-----	-----

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay with Sand

117+00 East Edge

Sample 1U

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 5-22-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L),in: 2.6	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D),cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A),sq. cm: 41.16	CONSOLIDATION PRESSURE,psi: 7
	B PARAMETER: 0.92
	HYDRAULIC GRADIENT (H),psi: 10

TEST DATA

CLOCK TIME 5-20,5-22	TIME (T) (min)	BURETTE CHANGE lower	upper	FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T[0.0006L/A \cdot H]$
5:10	245	1.0	1.0	1.0	$1.6 \times 10E-8$
7:50	880	2.8	3.0	2.9	$1.3 \times 10E-8$
1:10	320	0.8	0.9	0.85	$1.0 \times 10E-8$
4:40	210	0.55	0.5	0.525	$9.5 \times 10E-9$
7:10	870	2.25	2.3	2.275	$9.9 \times 10E-9$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 1 \times 10E-8$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
11.7	125.7	82.6	31.4	28	15	13	-----	-----

MATERIAL DESCRIPTION

Gray Silty Clay with Sand

SAMPLE LOCATION

122+00 West Edge

Sample 2U

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 5-22-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.15	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.94
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 5-27, 5-29	TIME (T) (min)	BURETTE CHANGE lower upper		FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T[0.0006L/A \cdot H]$
4:50	260	0.7	0.8	0.75	$9.0 \times 10E-9$
7:50	900	2.8	2.6	2.7	$9.4 \times 10E-9$
1:20	330	1.0	1.1	1.05	$9.9 \times 10E-9$
4:45	205	0.6	0.6	0.6	$9.2 \times 10E-9$
2:05	860	2.6	2.6	2.6	$9.5 \times 10E-9$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 9 \times 10E-9$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
13.9	---	---	---	--	--	--	----	----

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Separation Berm Sample 3U
N111+00 E93+75 Lift 5

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.25	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.98
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 5=30, 6-2	TIME (T) (min)	BURETTE lower	CHANGE upper	FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T [0.0006L/A \cdot H]$
12:30	1170	7.7	7.3	7.5	$2.1 \times 10E-8$
9:40	2710	10.1	10.2	10.15	$1.2 \times 10E-8$
1:45	215	0.8	0.8	0.8	$1.2 \times 10E-8$
5:00	225	0.8	0.8	0.8	$1.2 \times 10E-8$
7:15	855	2.8	3.0	2.9	$1.1 \times 10E-8$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 1 \times 10E-8$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
14.3	114.4*	83.6	32.0	25	12	13	120.4	12.4

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay

Separation Berm Sample 6R
N112+00 E93+75 Lift 6

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.3	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 2.85	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.94
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 5-27, 5-29	TIME (T) (min)	BURETTE CHANGE lower upper		FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T [0.0006L/A \cdot H]$
4:50	260	1.8	1.7	1.75	$2.3 \times 10E-8$
7:50	900	5.8	5.9	5.85	$2.2 \times 10E-8$
1:20	330	2.1	2.05	2.075	$2.1 \times 10E-8$
4:45	205	1.3	1.25	1.275	$2.1 \times 10E-8$
7:05	855	5.7	5.6	5.65	$2.2 \times 10E-8$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 2 \times 10E-8$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
13.1	119.2	80.8	29.7	27	14	13	----	----

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay

Separation Berm Sample 4U
N115+00 E93+75 Lift 6

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.2	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.96
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 5-30, 6-2	TIME (T) (min)	BURETTE CHANGE lower	CHANGE upper	FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T[0.0006L/A \cdot H]$
12:30	1170	7.4	7.2	7.3	$2.0 \times 10E-8$
9:40	2710	9.9	10.05	9.975	$1.2 \times 10E-8$
1:15	215	0.8	0.75	0.775	$1.2 \times 10E-8$
5:00	225	0.7	0.8	0.75	$1.1 \times 10E-8$
7:15	855	2.9	2.9	2.9	$1.1 \times 10E-8$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 1 \times 10E-8$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
11.1	---	80.9	31.5	26	13	13	----	----

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay

Separation Berm Sample 5U
N108+00 E93+75 Lift 8

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.4	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.96
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 5-30, 6-2	TIME (T) (min)	BURETTE lower	CHANGE upper	FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T [0.0006L/A \cdot H]$
1:15	215	1.3	1.3	1.30	$2.1 \times 10E-8$
5:00	225	1.3	1.2	1.25	$1.9 \times 10E-8$
7:15	855	4.3	4.4	4.35	$1.8 \times 10E-8$
11:30	255	1.3	1.3	1.30	$1.8 \times 10E-8$
4:30	300	1.4	1.5	1.45	$1.7 \times 10E-8$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 2 \times 10E-8$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
13.3	---	---	---	--	--	--	----	----

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Separation Berm Sample 6U
N116+50 E93+75 Lift 9

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.65	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.96
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 6-22, 6-23	TIME (T) (min)	BURETTE CHANGE lower upper		FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T[0.0006L/A \cdot H]$
6:50	3830	7.3	7.3	7.3	$7.4 \times 10E-9$
11:35	285	0.5	0.5	0.5	$6.8 \times 10E-9$
4:00	265	0.5	0.5	0.5	$7.3 \times 10E-9$
6:10	850	1.5	1.5	1.5	$6.8 \times 10E-9$
9:30	200	0.3	0.4	0.35	$6.8 \times 10E-9$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 7 \times 10E-9$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
15.6	115.8	88.6	35.9	26	13	13	121.9	12.5

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Borrow Pit N119+00 Lift 11
Sample 10R

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-23-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.45	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.94
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 6-15, 6-17	TIME (T) (min)	BURETTE CHANGE lower	upper	FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T [0.0006L/A \cdot H]$
7:45	3645	7.4	8.0	7.7	$7.5 \times 10E-9$
6:30	865	1.7	1.7	1.7	$7.0 \times 10E-9$
12:00	330	0.6	0.7	0.65	$7.0 \times 10E-9$
4:15	255	0.5	0.5	0.5	$7.0 \times 10E-9$
6:20	845	1.7	1.7	1.7	$7.2 \times 10E-9$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 7 \times 10E-9$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
14.8	118.5	87.4	33.9	26	14	12	----	----

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Separation Berm Sample 8U
N121+00 Lift 11

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

Remarks:

Reviewed By: Don Mich

GILES ENGINEERING ASSOCIATES, INC.

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.57	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.98
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 6-12, 6-17	TIME (T) (min)	BURETTE lower	CHANGE upper	FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T[0.0006L/A \cdot H]$
4:05	500	1.4	1.3	1.35	$1.0 \times 10E-8$
6:30	865	2.1	2.2	2.15	$9.3 \times 10E-9$
12:00	330	0.8	0.9	0.85	$9.7 \times 10E-9$
4:15	255	0.7	0.6	0.65	$9.6 \times 10E-9$
6:20	845	2.1	2.1	2.10	$9.3 \times 10E-9$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 1 \times 10E-8$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
14.6	121.0	85.4	35.8	28	14	14	----	----

MATERIAL DESCRIPTION

SAMPLE LOCATION

Brown Silty Clay

Separation Berm Sample 7U
N117+00 E93+75 Lift 15

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.5	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.98
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 6-15, 6-17	TIME (T) (min)	BURETTE CHANGE lower upper		FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T[0.0006L/A \cdot H]$
4:05	500	1.7	1.6	1.65	$1.1 \times 10E-8$
6:30	865	2.7	2.9	2.8	$1.2 \times 10E-8$
12:00	330	1.0	1.0	1.0	$1.1 \times 10E-8$
4:15	255	0.9	0.8	0.85	$1.2 \times 10E-8$
6:20	845	2.6	2.7	2.65	$1.1 \times 10E-8$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 1 \times 10E-8$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
14.6	119.8	85.4	34.2	25	13	12	----	----

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Separation Berm Sample 9U
N122+00 Lift 18

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

Appendix E-3D

Construction Documentation, June 1992

▲ Construction Documentation

**Winthrop Harbor
Clay Division Berm
Stations 11700N to 12380N
Constructed June 2-11, 1992**

Prepared for:



**Browning-Ferris Industries
of Illinois, Inc.**

June 1992

CONSTRUCTION DOCUMENTATION

**WINTHROP HARBOR
CLAY DIVISION BERM**

**STATIONS 11700N TO 12380N
CONSTRUCTED JUNE 2 - JUNE 11, 1992**

PREPARED FOR

BROWNING-FERRIS INDUSTRIES OF ILLINOIS, INC.

June 1992

**SEC Donohue Inc.
4738 North 40th Street
Sheboygan, WI 53083**

SEC Donohue Project No. 19857

1.0 INTRODUCTION

This report documents construction, testing, and inspection for the clay division berm at Winthrop Harbor Landfill, Zion, Illinois. Project development involved construction of an approximately 680-foot long clay division berm. This portion of the clay division berm was constructed from the north end of the existing clay berm at about Station 11700N, in a northerly direction to about Station 12380N. The approximate limits of the clay berm and project stationing are shown on the "Existing Site Conditions" drawing, provided in Appendix A.

SEC Donohue Inc. was present during construction of the clay division berm to provide construction quality assurance services including: field observations and testing, collection of soil samples for laboratory testing, and daily documentation of construction activities. Construction quality assurance services are summarized in more detail in the following discussions.

This report constitutes certification of substantial compliance with Illinois Environmental Protection Agency (IEPA) Supplemental Permit No. 1985-226-SP, provided in Appendix B.

Personnel involved in project development and construction are as follows:

- o Browning-Ferris Industries of Illinois, Inc. - Owner
 Don Sampson - Landfill Manager
 John Dixon - Vice President of Operations
- o SEC Donohue Inc. - Construction Quality Assurance
 Thomas Windau - Certifying Engineer, Project Manager
 Jim Michels - Inspector
- o Ryan, Inc. - Earthwork Contractor
 Don Kuzik - Supervisor
- o Giles Engineering Associates, Inc. - Soil Testing Laboratory
 Don Mich - Laboratory Supervisor

2.0 CONSTRUCTION ACTIVITIES

Construction for the clay division berm began on June 2, 1992. Ryan, Inc., performed all related earthwork activities. The location of the clay division berm was determined and set by BFI and Ryan, Inc. Fill materials utilized for construction generally consisted of a mixture of gray silty clays obtained from on-site borrow areas. Placement of the clay was performed by 20-cubic yard scrapers. After placement, each lift of clay was disced and compacted by a self-propelled sheepsfoot roller. Lift thickness was approximately 6 inches compacted. Clay lifts were tested for compaction in accordance with project specifications. Clay placement operations were complete on June 11, 1992.

Total volume of clay placed was approximately 9,826 in-place cubic yards. Clay volume calculations are provided in Appendix C. Project station cross sections are provided in Appendix D. Photographs showing clay division berm construction activities are provided in Appendix E.

3.0 INSPECTION ACTIVITIES

SEC Donohue Inc. provided continuous inspection and documentation services during construction of the clay division berm between the period of June 2 through June 11, 1992. During this period, the SEC Donohue inspector visually observed construction activities, performed in-field density tests on compacted clay, documented location of the berm as determined by BFI and Ryan, Inc., and collected soil samples for laboratory testing. Observations were recorded on daily field reports.

A total of 111 in-field density tests were performed by the SEC Donohue inspector to monitor in-place clay moisture and density values. Clay density and moisture content were measured with a Troxler Nuclear Density/Moisture Gauge in accordance with ASTM D2922.

Material used to construct the berm was obtained from borrow area Cell 2. Laboratory data indicated a maximum dry density of 113.8 pcf for material from Cell 2. The value of 113.8 pcf was used throughout construction for determining in-place moisture content and percent compaction. Density test results indicated compaction meeting or exceeding project specifications of 95 percent of Standard Proctor. Field density test results are provided in Appendix F.

Clay division berm grade documentation was periodically performed to aid in estimating clay quantities. All documentation was referenced from site grid stationing. Stationing is shown on the drawing, "Existing Site Conditions", provided in Appendix A.

4.0 SOIL TESTING

Laboratory tests were performed on clay soil samples to verify index properties (i.e., Atterberg Limits and P200 content) and permeability in accordance with project specifications and IEPA Supplemental Permit No. 1985-226-SP. Laboratory soil test results are provided in Appendix G. The laboratory report in Appendix G includes results for three clay division berm projects:

- 1) Station 11700N to 12380N constructed May 6 through May 27, 1992;
- 2) Station 10580N to 11700N constructed May 6 through June 2, 1992; and
- 3) Station 11700N to 12380N constructed June 2 through June 11, 1992.

For this project, a total of four tests were performed for Atterberg Limits and P200 content determinations. Test results indicated that Plasticity Indices (PI) and P200 contents ranged from 12 to 14 and 85.4 to 88.6 percent, respectively. Based on laboratory index tests, the sidewall liner soil is classified "Gray Silty Clay" (CL) as determined by the Unified Soil Classification System.

Three relatively undisturbed clay samples were recovered by Shelby tubes for laboratory hydraulic conductivity testing. Hydraulic conductivity test results indicate permeabilities of the clay samples of 7×10^{-9} cm/sec, 1×10^{-8} , and 1×10^{-8} cm/sec, which are less than the required maximum of 1×10^{-7} cm/sec.

5.0 CONCLUSION

During construction of this portion of the clay division berm at the Winthrop Harbor facility, SEC Donohue performed quality assurance services. These services included field observations and clay density/moisture testing, and collection of soil samples for laboratory testing. In summary, field and laboratory test results showed substantial compliance to project specifications, indicating construction of the clay division berm was performed in a satisfactory manner.

6.0 CERTIFICATION

Based on our professional judgement on information obtained through on-site observations and field and laboratory soil test results, the clay division berm for the Winthrop Harbor facility was constructed in substantial accordance with project specifications.



Thomas Windau, P.E.
Certifying Engineer

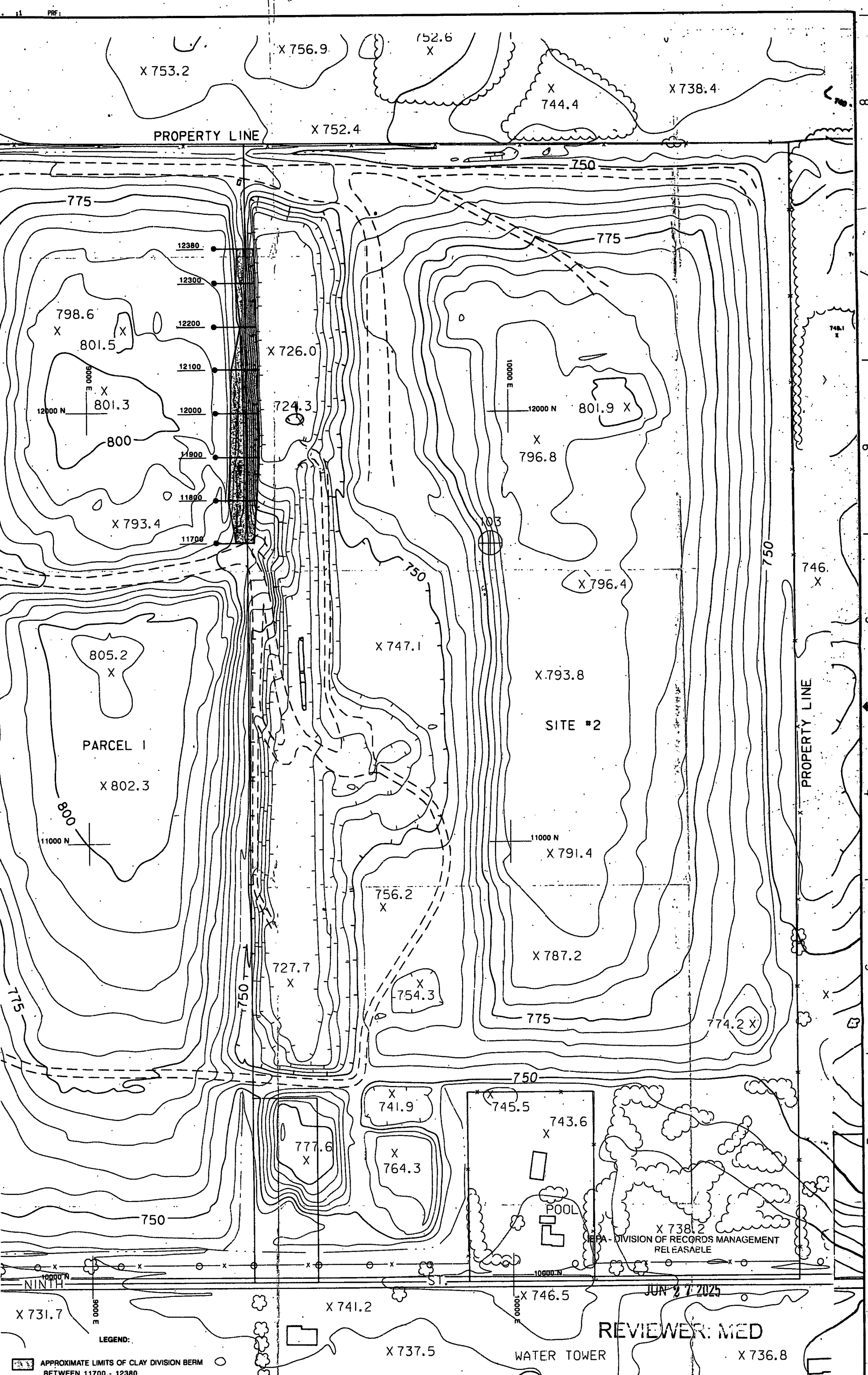
RP/BFIWINTH/AB2



APPENDIX A
EXISTING SITE CONDITIONS

APPENDIX B

**ILLINOIS ENVIRONMENTAL PROTECTION
AGENCY SUPPLEMENTAL PERMIT**



LEGEND:
APPROXIMATE LIMITS OF CLAY DIVISION BERM
BETWEEN 11700 - 12380

NOTE:

REVIEWER: MED

DATE: JUN 27 2025

R 001095



217/782-6762

Refer to: 0978020001 — Lake County
Winthrop Harbor/BFI #1
Supplemental Permit No. 1985-226-SP
Log Nos. 1985-090 and 1985-226

March 20, 1986

Browning-Ferris Industries
1827 Walden Office Square, Suite 107
Schaumburg, Illinois 60195

Gentlemen:

Supplemental permit is hereby granted to Browning-Ferris Industries, as owner and operator, to construct a berm along the eastern boundary of the above-referenced solid waste management site and to deposit non-hazardous waste in the area between this berm and the existing contours of the site. Final plans, specifications, application and supporting documents as submitted and approved shall constitute part of this permit and are identified in the records of the Illinois Environmental Protection Agency, Division of Land Pollution Control by the permit number and log number designated in the heading above.

This supplemental permit is issued subject to the standard conditions attached hereto and incorporated herein by reference, and further subject to the following special conditions:

1. In case of conflict between the application and plans submitted and these special conditions, the special conditions of this permit shall govern development and operation of the subject site.
2. Only nonhazardous wastes may be disposed in the area which is the subject of this permit.
3. After receipt at the site, but prior to disposal, every container of waste to be disposed in this area shall be sampled and analyzed by the paint filter test described in 35 Ill. Adm. Code 729.320. No wastes that yield fluid may be deposited in this area.
4. The diversion berm shall be constructed in accordance with the specifications identified in the document entitled "Slope Stability Analysis, Winthrop Harbor Landfill Nos. 1 & 2, Waukegan, Illinois," by Donohue and Associates, dated December, 1985. To ensure these specifications are met, the Construction Documentation Program in Appendix B of this document shall be adhered to, with the following exceptions:



Page 2

- a. Lifts of soil no more than nine inches thick (+) shall be used in constructing the berms;
 - b. Each lift shall be disced prior to compacting;
 - c. The soil placed in each lift shall be approximately three to five percent above the optimum moisture content to ensure the desired permeability is obtained upon compaction. If the moisture content of the soil excavated for use is below this level, water shall be added to obtain the desired moisture content.
 - d. Each lift shall be compacted to 95% of the Standard Proctor density (ASTM: D698);
 - e. The field density of each compacted lift shall be determined on 200 feet intervals. ASTM methods shall be used in making this determination;
 - f. One lab moisture density test shall be conducted for every 5000 cubic yards of soil used in constructing the berm, or when the borrow soil changes. The P200, clay content (less than 0.002 mm), grain size distribution curve, Atterburg limits and USCS soil classification shall be determined at the same frequency.
 - g. Provisions shall be made to key the bottom of each successive ten foot berm into the top of the lower berm. This may include scarifying and wetting the top of the lower berm prior to placing the initial lift of the upper berm. Other procedures may also be used to key the upper berm into the lower berm.
5. A registered professional engineer shall certify that the soil used in the construction of the berm:
- a. Is compacted to a minimum density which is 95 percent of the Standard Proctor Density (ASTM:D698);
 - b. Has an in-place permeability no greater than 1×10^{-7} cm/sec.

This certification shall be submitted to the Agency, as described in Special Condition No. 6 below. A report from a registered professional engineer documenting that the berm was constructed in accordance with the procedures set forth in Special Condition No. 4 above shall also be submitted to the Agency. These documents shall be developed each time a portion of the berm is constructed, and shall be submitted to the Agency before waste is placed against the newly constructed berm.



Illinois Environmental Protection Agency · 2200 Churchill Road, Springfield, IL 62706

Page 3

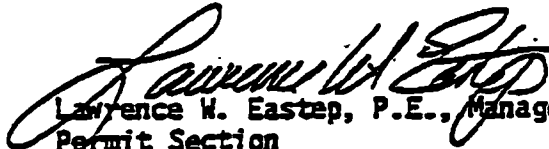
6. Unless otherwise indicated, all certifications, logs, reports and plan sheets which are required to be submitted to the Agency by the permittee shall be mailed to the following address:

Illinois Environmental Protection Agency
Compliance Monitoring Section
Division of Land Pollution Control -- #24
2200 Churchill Road
Springfield, Illinois 62706

7. Prior to placing waste against a portion of the newly constructed berm, the berm shall be inspected and approved by the Field Operations Section of this Division.

Except as modified in the above documents and in any supplemental permits issued by the Agency, this site shall be developed and operated in accordance with the terms and conditions of Permit No. 1975-53-OP, dated November 11, 1975:

Very truly yours,


Lawrence W. Eastep, P.E., Manager
Permit Section
Division of Land Pollution Control

LWE:JKM:rd0601F/1-3

Attachment

cc: Division File
Northern Region
Donohue and Associates
Fred Prillaman

APPENDIX C

VOLUME CALCULATIONS

VOLUME COMPUTATIONS

Donohue
Engineers & Architects

CLIENT BFI-WINTHROP HARBOR PAGE NO. 1

NORTH END
PROJECT CLAY DIVISION BERM PROJECT NO. 19857

DATE 6/24/92 BY 70W CHECKED BY RG

CUT OR (FILL) MATERIAL _____
(CIRCLE ONE)

STATION	SECTION LIMITS	DISTANCE	END AREA	TOTAL OF END AREAS	AVERAGE END AREA	VOLUME
123 + 80			0			
		80		246.3	123.15	9,852
123			246.3			
		100		531.9	265.95	26,595
122			285.6			
		100		756.0	378.0	37,800
121			470.4			
		100		965.8	482.9	48,290
120			495.4			
		100		1,028.1	514.05	51,405
119			532.7			
		100		923.7	461.85	46,185
118			391.0			
		100		903.6	451.8	45,180
117			512.6			

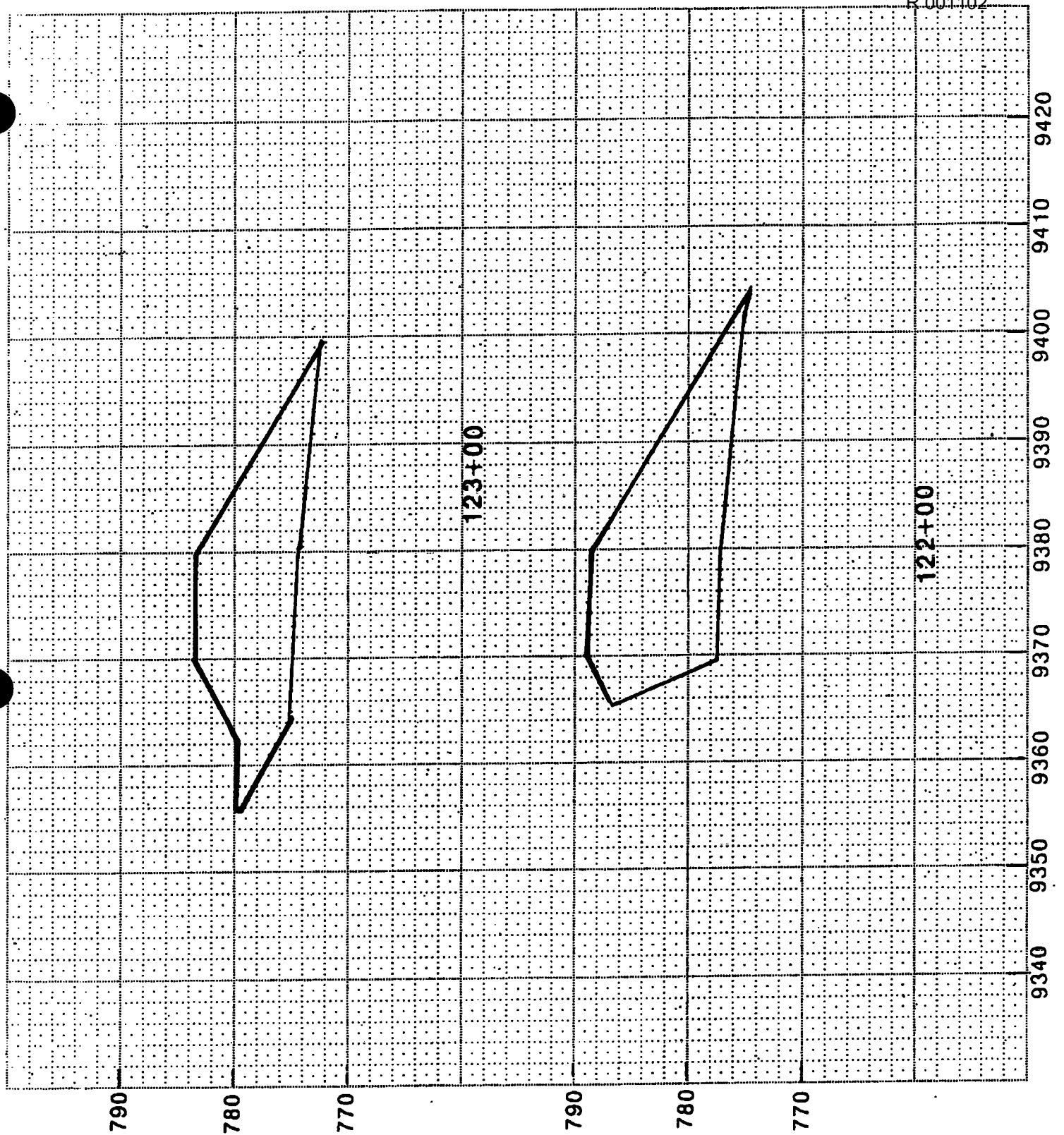
COMMENTS:

TOTAL = 265,307 CF

= 9,826

APPENDIX D

CLAY DIVISION BERM CROSS-SECTIONS

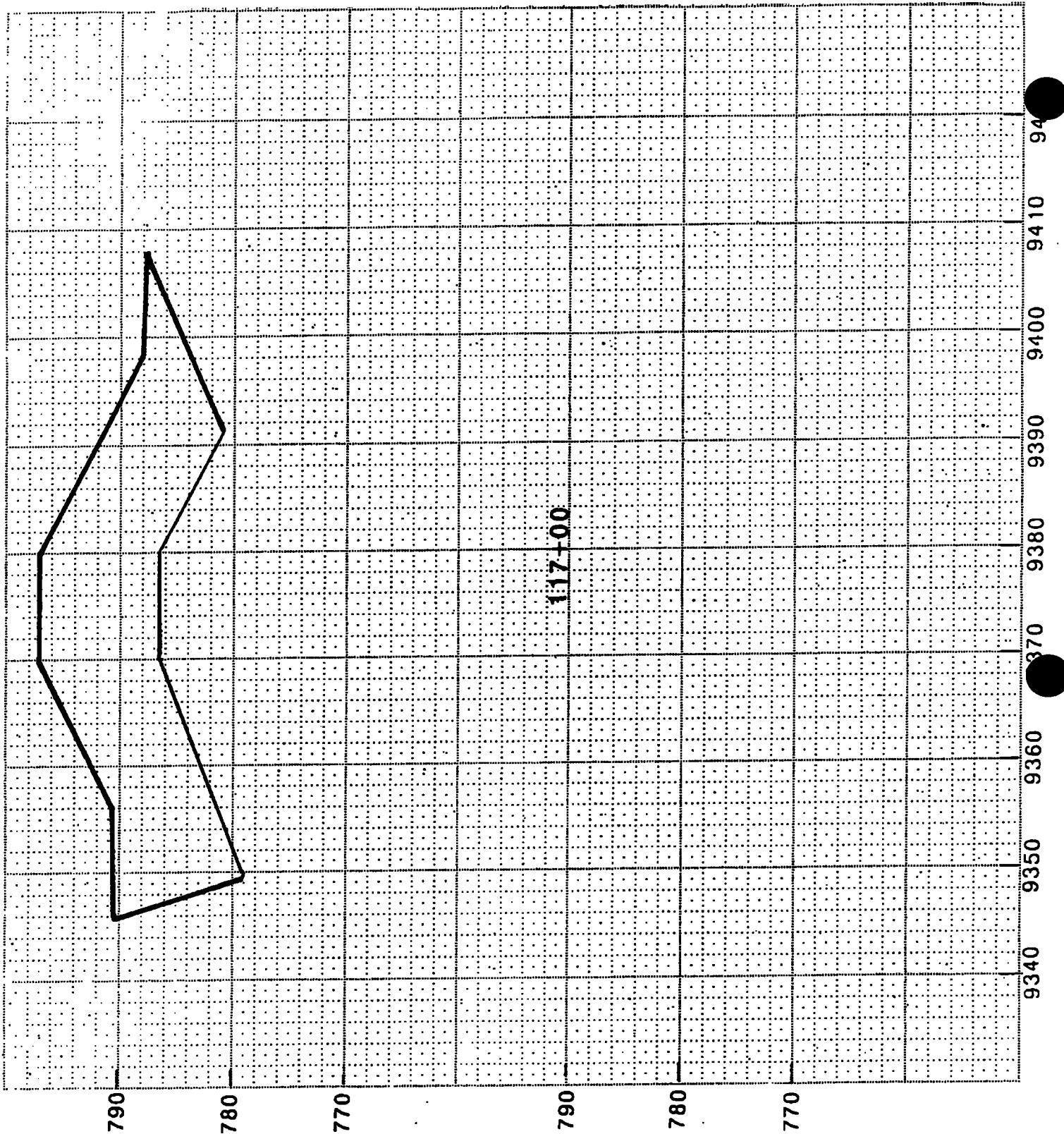


MAY, 1992

CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

19766 300

Donohue ENGINEERS
ARCHITECTS
SCIENTISTS

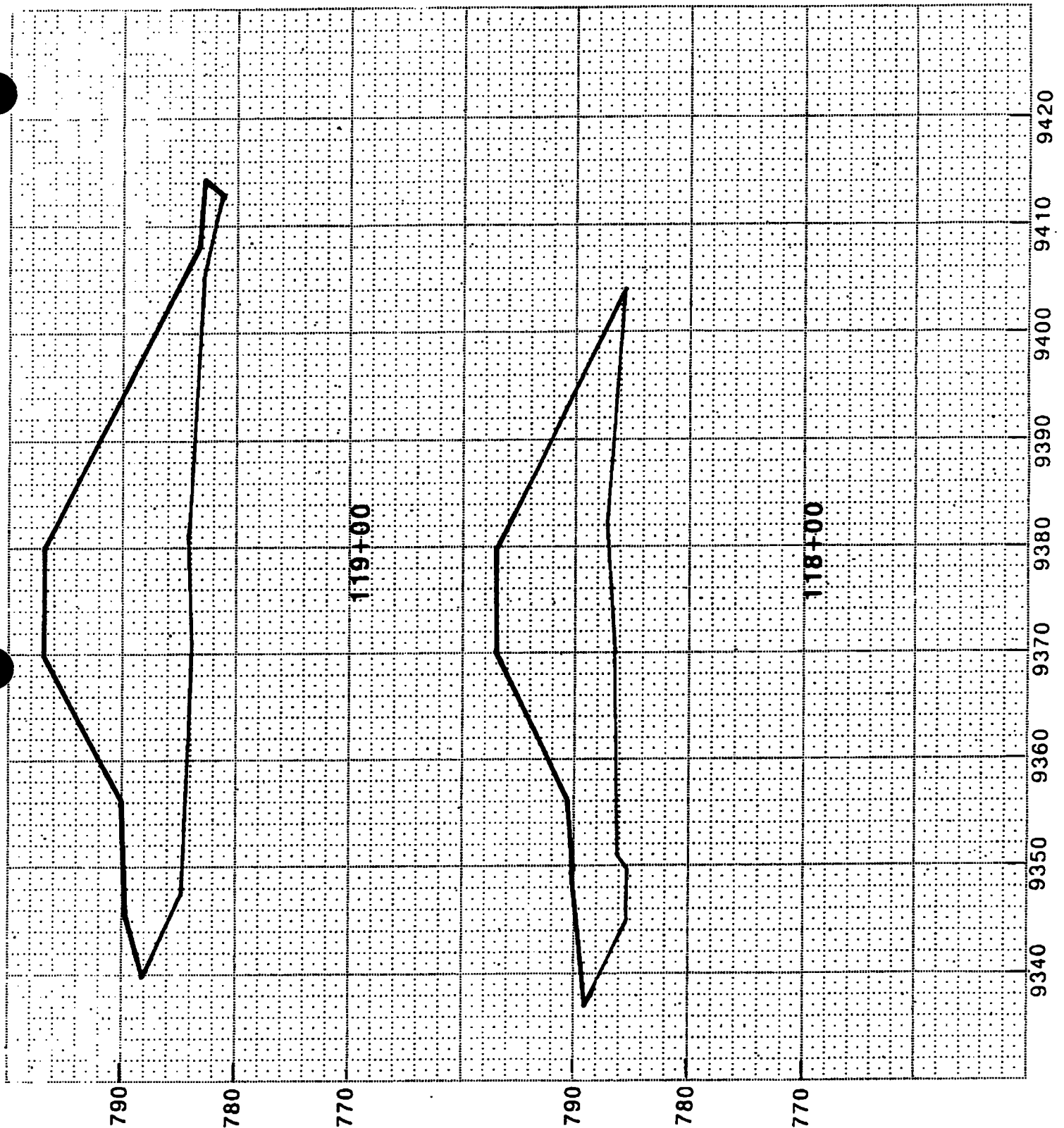


MAY, 1992

CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

19766 300

Donohue ENGINEERS
 ARCHITECTS
 SCIENTISTS

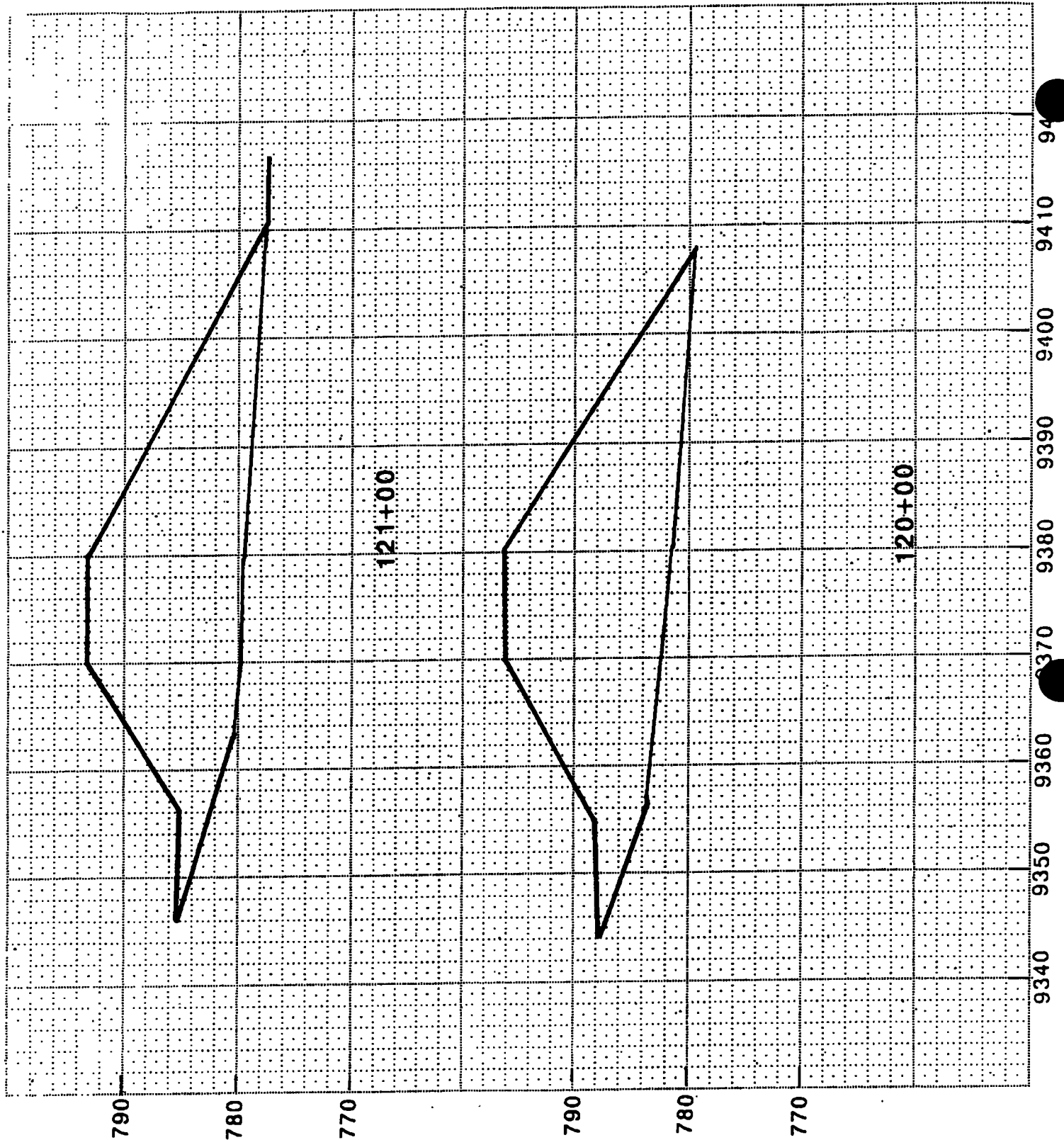


MAY, 1992

CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

19766 300

Donohue ENGINEERS
 ARCHITECTS
 SCIENTISTS



MAY, 1992

CROSS SECTIONS
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

19766 300

Donohue ENGINEERS
ARCHITECTS
SCIENTISTS

APPENDIX E

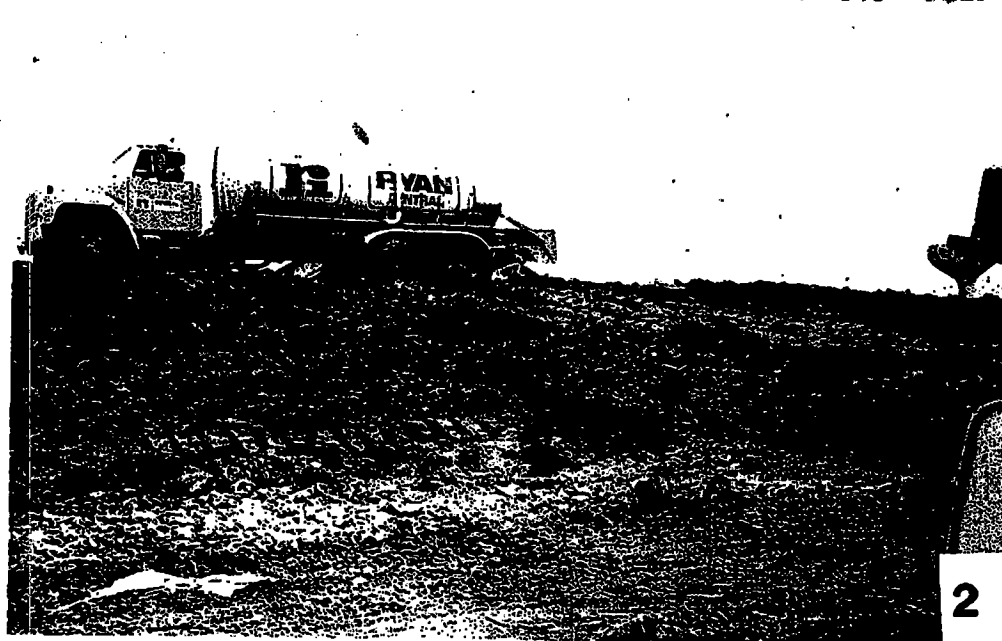
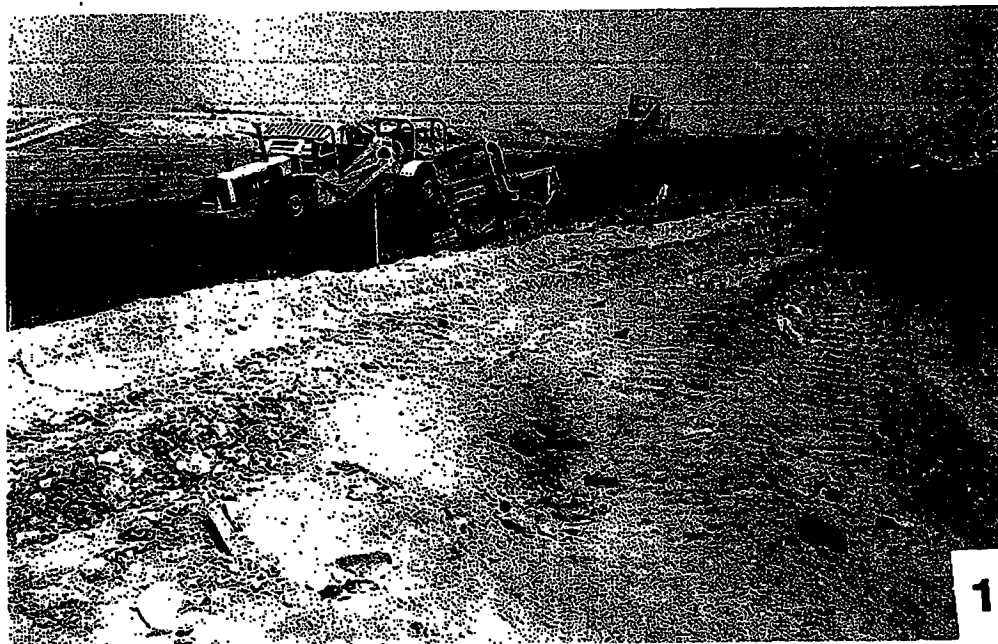
PHOTOGRAPHS

APPENDIX E

PHOTOGRAPHS

<u>Photograph No.</u>	<u>Description</u>
1	Placement and compaction of clay material.
2	Adding moisture prior to placement of additional clay material.
3	Leveling of clay material prior to placement of additional clay material.
4	Finished clay division berm.

RP/BFIWINTH/AB7





APPENDIX F
FIELD DENSITY TEST RESULTS

NUCLEAR DENSITY TESTS FOR
WINTHROP HARBOR
CLAY DIVISION BERM
ZION, ILLINOIS

DATE	TEST	RETEST	STATION	OFFSET	DESCRIPTK	ELEVATION	DEPTH OF PROBE	WET DENSITY PCF	DRY DENSITY PCF	MOISTURE PERCENT MOISTURE	STANDARD PERCENT PROCTOR	PERCENT COMPACT	
06/02/92	18.12		117+00	CL	GSC		1.0	127.2	111.8	15.4	13.8	113.8	98.2
06/02/92	18.13		119+00	5 LT	GSC		1.0	126.2	109.1	17.1	15.7	113.8	95.9
06/03/92	19.01		121+00	5 RT	GSC		1.0	128.6	111.3	17.3	15.5	113.8	97.8
06/03/92	19.02		118+00	5 LT	GSC		2.0	124.3	108.3	16.0	14.8	113.8	95.2
06/03/92	19.03		120+00	5 RT	GSC		2.0	125.3	106.9	18.4	17.2	113.8	93.9
06/03/92	19.04	19.03	120+00	5 RT	GSC		2.0	126.5	108.2	18.3	16.9	113.8	95.1
06/03/92	19.06		119+00	5 RT	GSC		3.0	127.2	108.5	18.7	17.2	113.8	95.3
06/03/92	19.07		117+00	5 LT	GSC		3.0	128.6	111.0	17.6	15.9	113.8	97.5
06/03/92	19.08		118+00	5 LT	GSC		2.0	126.3	109.0	17.3	15.9	113.8	95.8
06/03/92	19.09		121+00	5 LT	GSC		2.0	125.4	107.6	17.8	16.5	113.8	94.6
06/03/92	19.10		123+00	5 LT	GSC		1.0	125.0	109.5	15.5	14.2	113.8	96.2
06/03/92	19.11		124+00	5 RT	GSC		1.0	125.0	105.3	19.7	18.7	113.8	92.5
06/03/92	19.12	19.09	121+00	5 LT	GSC		2.0	126.5	110.3	16.2	14.7	113.8	96.9
06/03/92	19.13		122+00	5 RT	GSC		2.0	125.8	109.1	16.7	15.3	113.8	95.9
06/03/92	19.15	19.11	124+00	5 RT	GSC		1.0	125.1	108.7	16.4	15.1	113.8	95.5
06/03/92	19.16		118+00	5 RT	GSC		4.0	125.7	108.6	17.1	15.7	113.8	95.4
06/03/92	19.17		120+00	5 LT	GSC		3.0	126.7	108.1	18.6	17.2	113.8	95.0
06/03/92	19.18		122+00	5 LT	GSC		3.0	127.3	112.7	14.6	13.0	113.8	99.0
06/03/92	19.19		124+00	5 LT	GSC		3.0	127.8	109.1	18.7	17.1	113.8	95.9
06/03/92	19.20		117+00	5 RT	GSC		4.0	127.5	111.8	15.7	14.0	113.8	98.2
06/03/92	19.21	19.18	122+00	5 LT	GSC		3.0	127.2	108.8	18.4	16.9	113.8	95.6
06/04/92	20.01		117+00	5 LT	GSC		5.0	127.7	109.9	17.8	16.2	113.8	96.6
06/04/92	20.02		119+00	5 RT	GSC		5.0	128.4	112.4	16.0	14.2	113.8	98.8
06/04/92	20.03		120+00	5 LT	GSC		4.0	127.2	110.2	17.0	15.4	113.8	96.8
06/04/92	20.04		122+00	5 RT	GSC		4.0	127.4	109.9	17.5	15.9	113.8	96.6
06/04/92	20.05		123+00	5 LT	GSC		3.0	125.6	108.7	16.9	15.5	113.8	95.5
06/04/92	20.06		124+00	5 RT	GSC		1.0	128.2	111.1	17.1	15.4	113.8	97.6
06/04/92	20.07		117+00	5 LT	GSC		5.0	126.5	111.1	15.4	13.9	113.8	97.6
06/04/92	20.08		118+00	5 RT	GSC		5.0	126.3	108.1	18.2	16.8	113.8	95.0
06/04/92	20.09		121+00	5 LT	GSC		5.0	126.7	109.7	17.0	15.5	113.8	96.4
06/04/92	20.10		117+00	5 RT	GSC		6.0	126.8	111.7	15.1	13.5	113.8	98.2
06/04/92	20.11		119+00	5 LT	GSC		6.0	126.9	111.6	15.3	13.7	113.8	98.1
06/04/92	20.12		121+00	5 RT	GSC		6.0	126.0	108.6	17.4	16.0	113.8	95.4
06/04/92	20.13		123+00	5 RT	GSC		5.0	125.5	107.8	17.7	16.4	113.8	94.7
06/05/92	21.01		118+00	5 LT	GSC		6.0	123.9	105.6	18.3	17.3	113.8	92.8
06/05/92	21.02	21.01	118+00	5 LT	GSC		6.0	125.3	108.1	17.2	15.9	113.8	95.0
06/05/92	21.03		120+00	5 RT	GSC		6.0	123.1	105.9	17.2	16.2	113.8	93.1
06/05/92	21.04	21.03	120+00	5 RT	GSC		6.0	126.8	110.0	16.8	15.3	113.8	96.7
06/05/92	21.05		121+00	5 LT	GSC		6.0	124.5	109.5	15.0	13.7	113.8	96.2
06/05/92	21.06		122+00	5 LT	GSC		6.0	124.7	106.2	18.5	17.4	113.8	93.3
06/05/92	21.07		123+00	CL	GSC		6.0	124.2	106.3	17.9	16.8	113.8	93.4
06/05/92	21.08	21.06	122+00	5 LT	GSC		6.0	125.8	109.0	16.8	15.4	113.8	95.8
06/05/92	21.09	21.07	123+00	CL	GSC		6.0	124.9	108.9	16.0	14.7	113.8	95.7
06/05/92	21.10		124+00	CL	GSC		6.0	123.9	105.8	18.1	17.1	113.8	93.0
06/05/92	21.11	21.10	124+00	CL	GSC		6.0	126.0	109.0	17.0	15.6	113.8	95.8
06/05/92	21.12		117+00	CL	GSC		7.0	124.4	109.6	14.8	13.5	113.8	96.3
06/05/92	21.13		119+00	CL	GSC		7.0	124.4	104.9	19.5	18.6	113.8	92.2
06/05/92	21.14		121+00	5 RT	GSC		7.0	126.1	108.1	18.0	16.7	113.8	95.0

NUCLEAR DENSITY TESTS FOR
WINTHROP HARBOR
CLAY DIVISION BERM
ZION, ILLINOIS

DATE	TEST	RETEST	STATION	OFFSET	DESCRIPTIC	ELEVATION	DEPTH OF PROBE	WET DENSITY PCF	DRY DENSITY PCF	MOISTURE	PERCENT MOISTURE	STANDARD PROCTOR	PERCENT COMPACT
06/05/92	21.15		123+00	5 LT	GSC	7.0	12	125.5	108.8	16.7	15.3	113.8	95.6
06/05/92	21.17		120+00	CL	GSC	8.0	12	126.6	108.6	18.0	16.6	113.8	95.4
06/05/92	21.18		122+00	CL	GSC	8.0	12	125.1	108.6	16.5	15.2	113.8	95.4
06/05/92	21.19		124+00	CL	GSC	8.0	12	123.3	105.1	18.2	17.3	113.8	92.4
06/05/92	21.20	21.13	119+00	CL	GSC	7.0	12	127.0	109.2	17.8	16.3	113.8	96.0
06/05/92	21.21		121+00	CL	GSC	8.0	12	126.3	108.5	17.8	16.4	113.8	95.3
06/05/92	21.22	21.19	124+00	CL	GSC	8.0	12	125.0	108.0	17.0	15.7	113.8	94.9
06/08/92	22.01		117+00	5 LT	GSC	9.0	12	127.0	109.6	17.4	15.9	113.8	96.3
06/08/92	22.02		119+00	5 RT	GSC	9.0	12	125.2	106.8	18.4	17.2	113.8	93.8
06/08/92	22.03		121+00	5 LT	GSC	9.0	12	125.2	106.1	19.1	18.0	113.8	93.2
06/08/92	22.04		123+00	5 RT	GSC	9.0	12	124.1	105.7	18.4	17.4	113.8	92.9
06/08/92	22.05		118+00	5 LT	GSC	9.0	12	126.9	109.7	17.2	15.7	113.8	96.4
06/08/92	22.06	22.02	119+00	5 RT	GSC	9.0	12	127.3	110.9	16.4	14.8	113.8	97.5
06/08/92	22.07	22.03	121+00	5 LT	GSC	9.0	12	126.7	108.7	18.0	16.6	113.8	95.5
06/08/92	22.08		124+00	5 LT	GSC	9.0	12	126.5	108.1	18.4	17.0	113.8	95.0
06/08/92	22.09	22.04	123+00	CL	GSC	9.0	12	128.0	110.2	17.8	16.2	113.8	96.8
06/08/92	22.10		118+00	5 RT	GSC	10.0	12	125.1	107.6	17.5	16.3	113.8	94.6
06/08/92	22.11		120+00	5 LT	GSC	10.0	12	124.2	105.4	18.8	17.8	113.8	92.6
06/08/92	22.12		122+00	5 RT	GSC	10.0	12	125.7	108.1	17.6	16.3	113.8	95.0
06/08/92	22.13		124+00	5 LT	GSC	10.0	12	126.7	109.4	17.3	15.8	113.8	96.1
06/08/92	22.14	22.10	118+00	5 RT	GSC	10.0	12	126.2	110.0	16.2	14.7	113.8	96.7
06/08/92	22.15		120+00	5 LT	GSC	10.0	12	125.7	108.5	17.2	15.9	113.8	95.3
06/08/92	22.16		117+00	5 RT	GSC	11.0	12	126.6	108.6	18.0	16.6	113.8	95.4
06/08/92	22.17		119+00	5 LT	GSC	11.0	12	125.2	109.9	15.3	13.9	113.8	96.6
06/08/92	22.18		121+00	5 RT	GSC	11.0	12	123.3	105.1	18.2	17.3	113.8	92.4
06/08/92	22.19		123+00	5 LT	GSC	11.0	12	125.1	104.9	20.2	19.3	113.8	92.2
06/08/92	22.20	22.18	121+00	CL	GSC	11.0	12	125.3	108.3	17.0	15.7	113.8	95.2
06/08/92	22.21	22.19	123+00	5 LT	GSC	11.0	12	126.1	108.3	17.8	16.4	113.8	95.2
06/09/92	23.01		118+00	5 LT	GSC	12.0	12	123.9	106.7	17.2	16.1	113.8	93.8
06/09/92	23.02		120+00	5 RT	GSC	12.0	12	126.0	109.1	16.9	15.5	113.8	95.9
06/09/92	23.03		122+00	5 LT	GSC	12.0	12	126.1	109.0	17.1	15.7	113.8	95.8
06/09/92	23.04		124+00	5 RT	GSC	12.0	12	125.3	109.3	16.0	14.6	113.8	96.0
06/09/92	23.05	23.01	118+00	5 LT	GSC	12.0	12	126.2	108.1	18.1	16.7	113.8	95.0
06/09/92	23.06		117+00	5 LT	GSC	13.0	12	126.4	110.1	16.3	14.8	113.8	96.7
06/09/92	23.07		119+00	5 RT	GSC	13.0	12	127.2	108.3	18.9	17.5	113.8	95.2
06/09/92	23.08		121+00	5 LT	GSC	13.0	12	122.1	104.0	18.1	17.4	113.8	91.4
06/09/92	23.09		123+00	5 RT	GSC	13.0	12	125.4	108.9	16.5	15.2	113.8	95.7
06/09/92	23.10	23.08	121+00	5 LT	GSC	13.0	12	125.5	109.0	16.5	15.1	113.8	95.8
06/09/92	23.11		118+00	5 RT	GSC	14.0	12	124.8	108.7	16.1	14.8	113.8	95.5
06/09/92	23.12		120+00	5 LT	GSC	14.0	12	126.8	107.7	19.1	17.7	113.8	94.6
06/09/92	23.13		122+00	5 RT	GSC	14.0	12	126.6	108.1	18.5	17.1	113.8	95.0
06/09/92	23.14		124+00	5 LT	GSC	14.0	12	124.5	109.3	15.2	13.9	113.8	96.0
06/09/92	23.15	23.12	120+00	5 LT	GSC	14.0	12	127.0	110.8	16.2	14.6	113.8	97.4
06/09/92	23.16		117+00	5 RT	GSC	15.0	12	124.0	109.0	15.0	13.8	113.8	95.8
06/09/92	23.17		119+00	5 LT	GSC	15.0	12	126.4	108.0	18.4	17.0	113.8	94.9
06/09/92	23.18		121+00	5 RT	GSC	15.0	12	123.8	104.7	19.1	18.2	113.8	92.0

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NUCLEAR DENSITY TESTS FOR
WINTHROP HARBOR
CLAY DIVISION BERM
ZION, ILLINOIS

DATE	TEST	RETEST	STATION	OFFSET	DESCRIPTIC	ELEVATION	DEPTH OF PROBE	WET DENSITY PCF	DRY DENSITY PCF	MOISTURE PERCENT	PERCENT MOISTURE	STANDARD PROCTOR	PERCENT COMPACT
06/09/92	23.19		123+00	5 LT	GSC	15.0	12	125.2	104.3	20.9	20.0	113.8	91.7
06/09/92	23.20	23.17	119+00	5 LT	GSC	15.0	12	126.5	109.6	16.9	15.4	113.8	96.3
06/09/92	23.21	23.18	121+00	5 RT	GSC	15.0	12	126.2	109.2	17.0	15.6	113.8	96.0
06/10/92	24.01	23.19	123+00	5 LT	GSC	15.0	12	129.8	114.1	15.7	13.8	113.8	100.3
06/10/92	24.02		119+00	5 LT	GSC	16.0	12	125.6	106.7	18.9	17.7	113.8	93.8
06/10/92	24.03		120+00	5 RT	GSC	16.0	12	124.2	106.7	17.5	16.4	113.8	93.8
06/10/92	24.04		122+00	5 LT	GSC	16.0	12	126.3	110.6	15.7	14.2	113.8	97.2
06/10/92	24.05	24.02	119+00	5 LT	GSC	16.0	12	124.3	109.0	15.3	14.0	113.8	95.8
06/10/92	24.06	24.03	120+00	5 RT	GSC	16.0	12	125.5	109.9	15.6	14.2	113.8	96.6
06/10/92	24.07		118+00	5 LT	GSC	17.0	12	127.0	110.0	17.0	15.5	113.8	96.7
06/10/92	24.08		119+00	5 RT	GSC	18.0	12	126.2	109.4	16.8	15.4	113.8	96.1
06/10/92	24.09		121+00	5 LT	GSC	17.0	12	126.3	109.3	17.0	15.6	113.8	96.0
06/10/92	24.10		123+00	5 RT	GSC	17.0	12	125.4	109.4	16.0	14.6	113.8	96.1
06/10/92	24.11		120+00	5 LT	GSC	18.0	12	125.8	108.1	17.7	16.4	113.8	95.0
06/10/92	24.12		122+00	5 RT	GSC	18.0	12	125.7	109.0	16.7	15.3	113.8	95.8
06/10/92	24.13		121+00	5 RT	GSC	19.0	12	127.2	108.5	18.7	17.2	113.8	95.3
06/10/92	24.14		123+00	5 LT	GSC	19.0	12	127.0	109.2	17.8	16.3	113.8	96.0

APPENDIX G

LABORATORY SOIL TEST RESULTS



MILWAUKEE, WI
LOS ANGELES, CA
WASHINGTON, D.C.

GILES ENGINEERING ASSOCIATES, INC.

GEOTECHNICAL, GEO-ENVIRONMENTAL
AND CONSTRUCTION MATERIALS CONSULTANTS

N8 W22350 JOHNSON ROAD, SUITE A1 / WAUKESHA, WI 53186
414-544-0118, FAX: 414-549-5868

June 24, 1992

SEC Donohue, Inc.
4738 North 40th Street
Sheboygan, WI

Attention: Mr. Jim Michaels

Subject: QA/QC Laboratory Testing Services
BF1-Zion Facility
701 Green Bay Road
Zion, Illinois
GEA Project No. 1M-920436

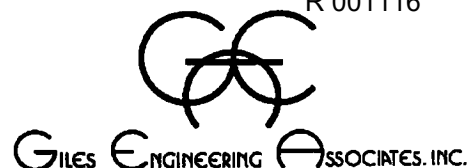
Dear Mr. Michaels:

In accordance with your request, Quality Assurance/Quality Control Laboratory Testing has been performed on landfill materials samples submitted by your personnel from the above referenced project. The purpose of the landfill (clay) testing was to determine pertinent engineering characteristics of the landfill materials for verification of project specification compliance.

The QA/QC Laboratory Testing has been performed in accordance with applicable ASTM Standards. Laboratory Testing for the materials submitted for this project consisted of performing the following tests.

1. Moisture Content (ASTM D2216).
2. Dry Density (ASTM D2732).
3. Grain Size Analysis (ASTM D422).
4. Atterberg Limits (ASTM D4318).
5. Standard Proctor (ASTM D698).
6. Falling Head Permeability (Flexible Wall).
7. USCS Soil Classification (ASTM D2487).

The test results are summarized on the following test data summary report and the individual test reports are appended.



BF1-Zion Facility
Zion, Illinois
GEA Project No. 1M-920436
Page 2

GEA appreciates the opportunity to be of continued service on this project. If there are any questions in regards to this letter or if GEA can be of further service please do not hesitate to call at any time.

Very truly yours,

GILES ENGINEERING ASSOCIATES, INC.

Shelley A. Hildebrandt

Shelley Hildebrandt, Geologist
Senior Lab Assistant

for Mich St

Don Mich, Geologist
Laboratory Manager

Daniel B. Anderson

Daniel B. Anderson, P.E.
Const. Materials Dept. Manager

Enclosures: Test Data Summary Reports
Report of Grain Size Analysis
Report of Proctor Test
Report of Permeability Test

JUN92\20/BU136/PAO
M436L.RFT

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.5	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.98
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 6-15, 6-17	TIME (T) (min)	BURETTE lower	CHANGE upper	FLOW (Q) (ml)	PERMEABILITY (cm/s) = Q/T [0.0006L/A*H]
4:05	500	1.7	1.6	1.65	1.1 x 10E-8
6:30	865	2.7	2.9	2.8	1.2 X 10E-8
12:00	330	1.0	1.0	1.0	1.1 X 10E-8
4:15	255	0.9	0.8	0.85	1.2 X 10E-8
6:20	845	2.6	2.7	2.65	1.1 X 10E-8

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 1 \times 10E-8$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
14.6	119.8	85.4	34.2	25	13	12	----	----

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Separation Berm Sample 9U
N122+00 Lift 18

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.45	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.94
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 6-15, 6-17	TIME (T) (min)	BURETTE lower	CHANGE upper	FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T[0.0006L/A \cdot H]$
7:45	3645	7.4	8.0	7.7	$7.5 \times 10E-9$
6:30	865	1.7	1.7	1.7	$7.0 \times 10E-9$
12:00	330	0.6	0.7	0.65	$7.0 \times 10E-9$
4:15	255	0.5	0.5	0.5	$7.0 \times 10E-9$
6:20	845	1.7	1.7	1.7	$7.2 \times 10E-9$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 7 \times 10E-9$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
14.8	118.5	87.4	33.9	26	14	12	----	----

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Separation Berm Sample 8U
N121+00 Lift 11

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.57	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.98
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 6-12, 6-17	TIME (T) (min)	BURETTE CHANGE lower	upper	FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T[0.0006L/A \cdot H]$
4:05	500	1.4	1.3	1.35	$1.0 \times 10E-8$
6:30	865	2.1	2.2	2.15	$9.3 \times 10E-9$
12:00	330	0.8	0.9	0.85	$9.7 \times 10E-9$
4:15	255	0.7	0.6	0.65	$9.6 \times 10E-9$
6:20	845	2.1	2.1	2.10	$9.3 \times 10E-9$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 1 \times 10E-8$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
14.6	121.0	85.4	35.8	28	14	14	----	----

MATERIAL DESCRIPTION

Brown Silty Clay

SAMPLE LOCATION

Separation Berm Sample 7U
N117+00 E93+75 Lift 15

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

SUMMARY OF QA/QC LABORATORY TEST RESULTS

ZION RDF

G.E.A. Project No. 1M-920436

SAMPLE ID NO.	LOCATION	IN SITU		GRAINSIZE		ATTERBERG LIMITS		USCS CLASS.	MOISTURE-DENSITY RELATION.		PERMEABILITY (cm/s)
		MOISTURE CONTENT (%)	DRY UNIT WEIGHT (p.c.f.)	P200 (%)	CLAY (0.002mm) (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)		MAXIMUM DRY DENSITY (p.c.f.)	OPTIMUM MOISTURE (%)	
1R	Cell 1	15.1	---	---	---	---	---	---	120.6	11.7	----
2R	Cell 2	11.7	---	---	---	---	---	---	113.8	14.0	----
1U	117+00 East Edge	13.0	122.7	84.1	30.9	28	13	CL	----	----	5 x 10E-9
2U	122+00 West Edge	11.7	125.7	82.6	31.4	28	13	CL	----	----	1 x 10E-8
3R	117+00 East Edge	12.9	---	82.8	34.2	29	14	CL	120.5	13.2	----
4R	122+00 West Edge	13.4	---	80.7	28.9	26	14	CL	122.5	12.1	----
5R	N116+00 E93+75 Lift 4	15.2	---	86.5	35.6	26	12	CL	120.6	12.7	----
3U	N111+00 E93+75 Lift 5	13.9	---	---	---	---	---	---	---	---	9 x 10E-9
6R	N112+00 E93+75 Lift 6	14.3	114.4*	83.6	32.0	25	12	CL	120.4	12.4	1 x 10E-8
4U	N115+00 E93+75 Lift 6	13.1	119.2	80.8	29.7	27	14	CL	----	----	2 x 10E-8
7R	N116+50 E93+75	15.8	---	83.7	32.6	26	13	CL	121.0	12.1	----
5U	N108+00 E93+75 Lift 8	11.1	---	80.9	31.5	26	13	CL	----	----	1 x 10E-8
* Remolded Density											
High											
Low											
Mean											

R 001120

SUMMARY OF QA/QC LABORATORY TEST RESULTS

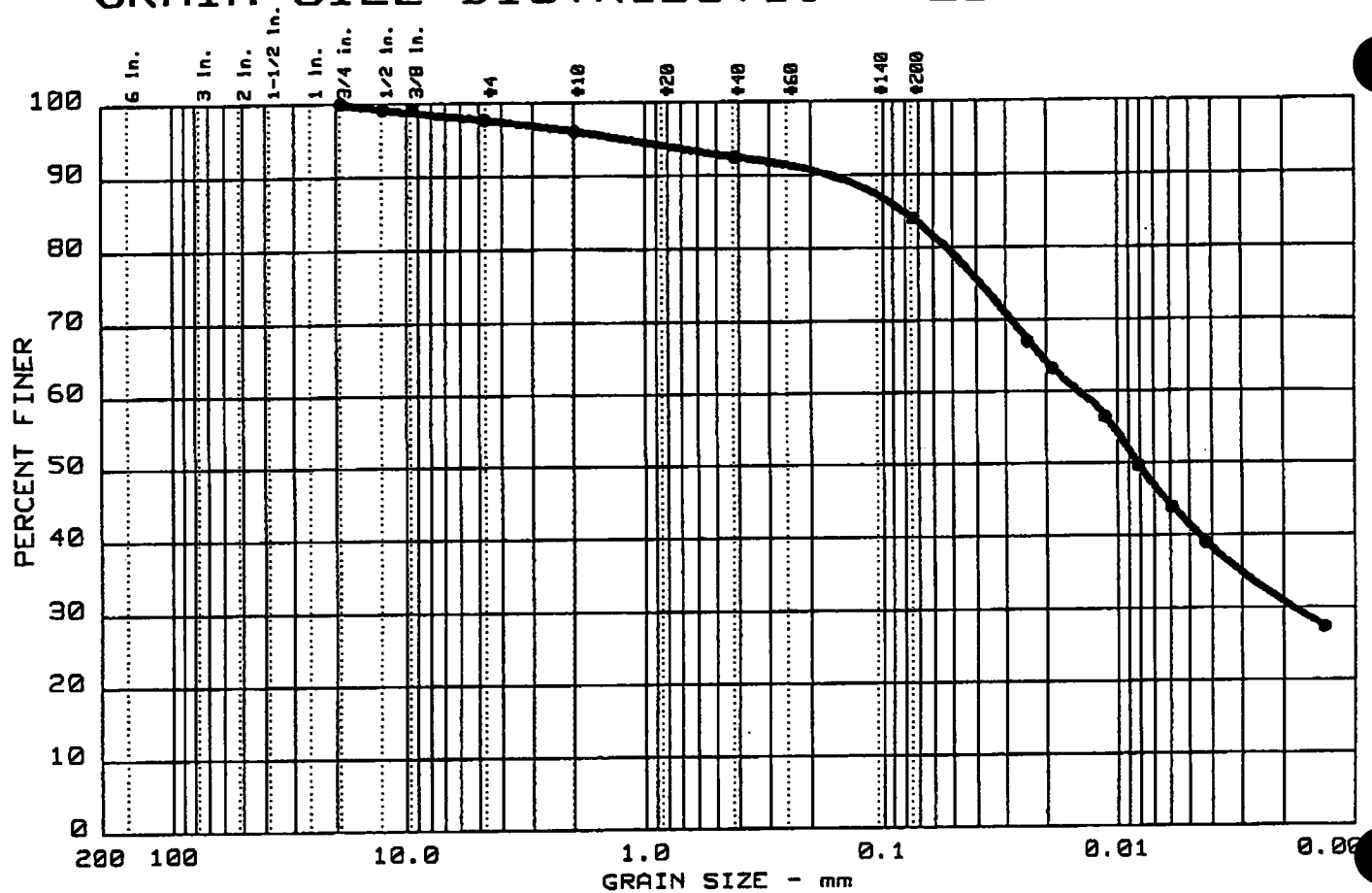
ZION RDF

G.E.A. Project No. 1M-920436

SAMPLE ID NO.	LOCATION	IN SITU		GRAINSIZE		ATTERBERG LIMITS		USCS CLASS.	MOISTURE-DENSITY RELATION.		PERMEABILITY (cm/s)
		MOISTURE CONTENT (%)	DRY UNIT WEIGHT (p.c.f.)	P200 (%)	CLAY (0.002mm) (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)		MAXIMUM DRY DENSITY (p.c.f.)	OPTIMUM MOISTURE (%)	
6U	N116+50 E93+75 Lift 9	13.3	---	---	---	---	---	---	---	---	$2 \times 10E-8$
8R	N109+50 E93+75 Lift 10	15.8	---	84.2	33.9	27	14	CL	122.8	11.7	---
9R	Borrow Site	19.8	---	68.0	24.0	26	11	CL	118.8	13.5	---
10R	Borrow Pit N119+00 Lift 11	15.6	115.8*	88.6	35.9	26	13	CL	121.9	12.5	$7 \times 10E-9$
8U	N121+00 Lift 11	14.8	118.5	87.4	33.9	26	12	CL	---	---	$7 \times 10E-9$
7U	N117+00 E93+75 Lift 15	14.6	121.0	85.4	35.8	28	14	CL	---	---	$1 \times 10E-8$
9U	N122+00 Lift 18	14.6	119.8	85.4	34.2	25	12	CL	---	---	$1 \times 10E-8$
* Remolded Density											
High		19.8	125.7	88.6	38.0	29	14		122.5	14.0	$9 \times 10E-9$
Low		11.1	114.4	68.0	24.0	25	11		113.8	11.7	$1 \times 10E-8$
Mean		15.5	120.1	78.3	31.0	27	12.5		118.2	12.9	$9.5 \times 10E-9$

R 001121

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
● Z	0.0	2.3	13.6	53.2	30.9	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
● 13.0	28	15	13.0	2.7		0.002			

MATERIAL DESCRIPTION	SAMPLE LOCATION
● Gray Silty Clay with Sand	● 1-U

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

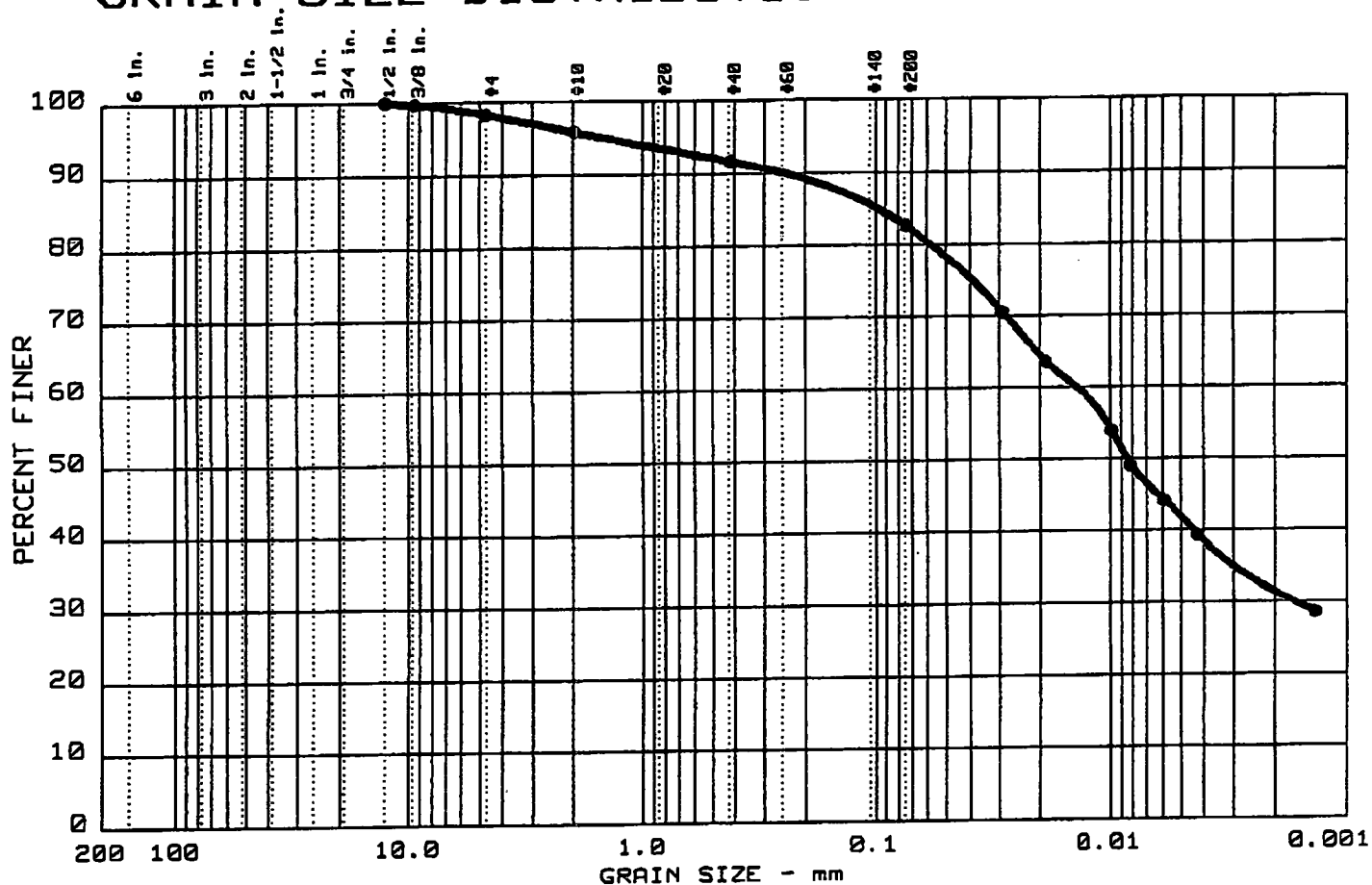
Date: 5-21-92

Giles Engineering Assoc., Inc.

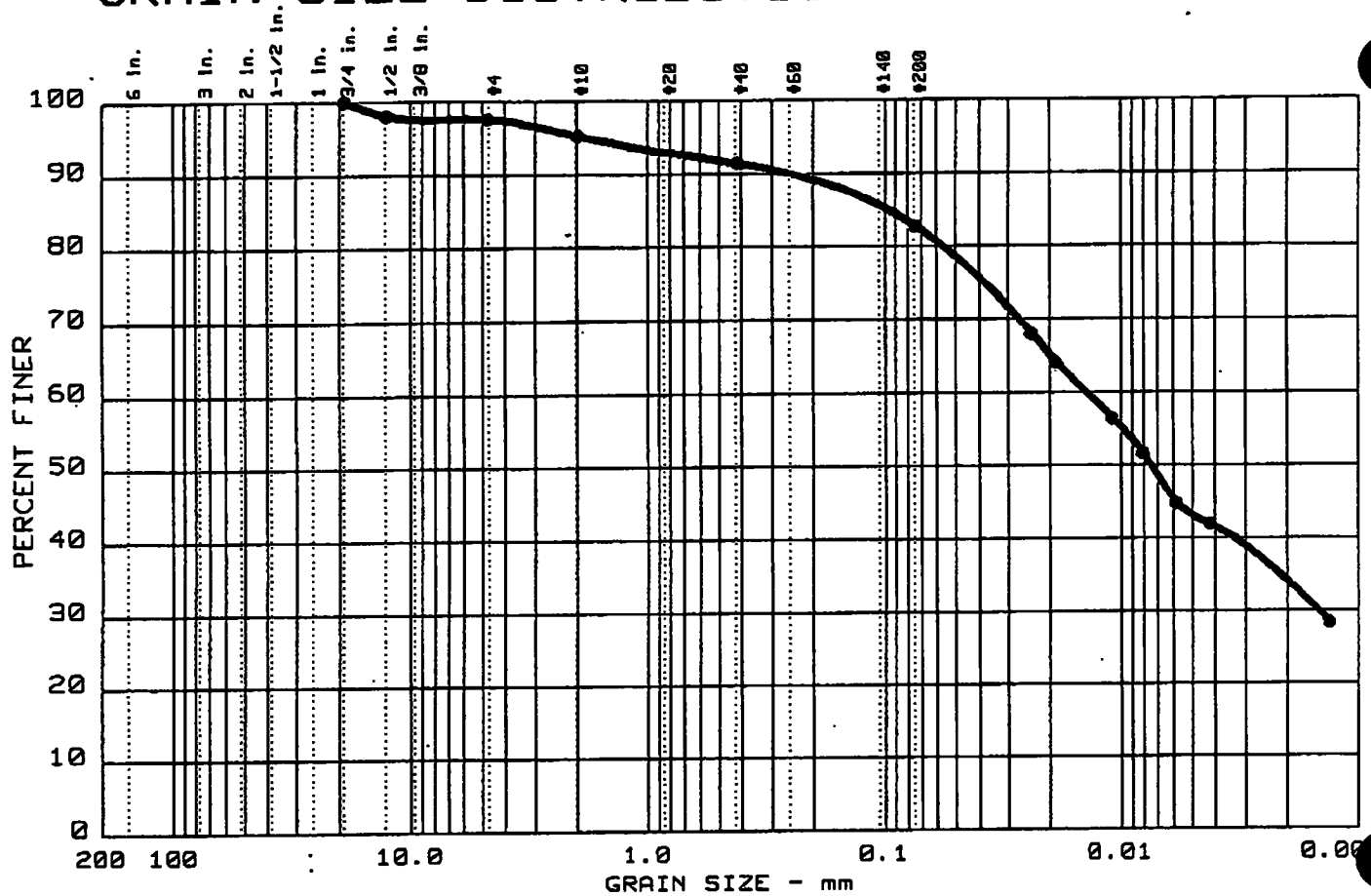
Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
• 3	0.0	2.3	14.9	48.6	34.2	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
• 12.9	29	15	14.0	2.7		0.001			

MATERIAL DESCRIPTION	SAMPLE LOCATION
• Gray-Brown Silty Clay with Sand	• 3-R

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

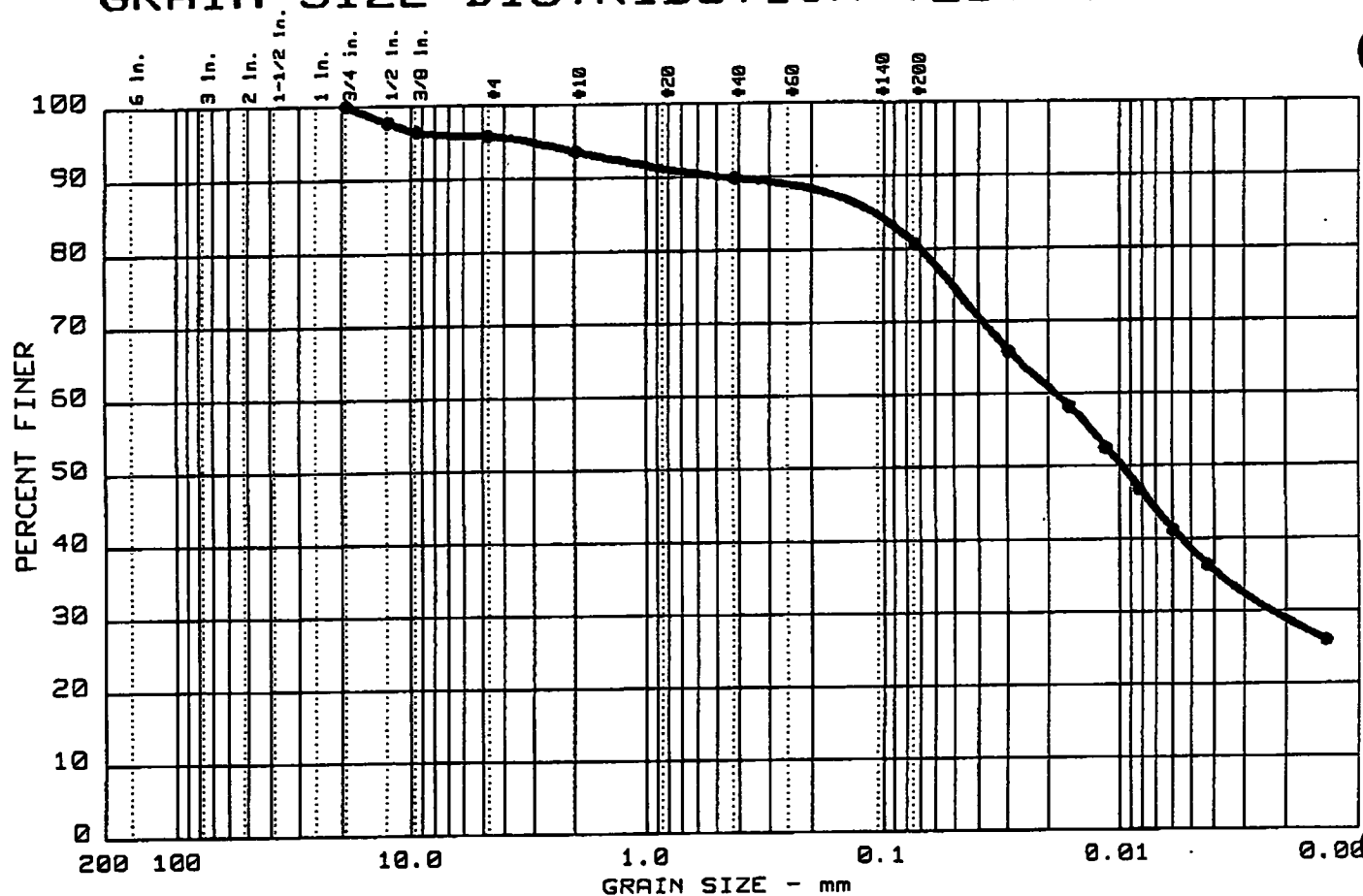
Date: 5-21-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
● 5	0.0	4.2	15.1	51.8	28.9	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
● 13.4	26	12	14.0	2.7		0.002			

MATERIAL DESCRIPTION	SAMPLE LOCATION
● Gray-Brown Silty Clay with Sand	● 4-R

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

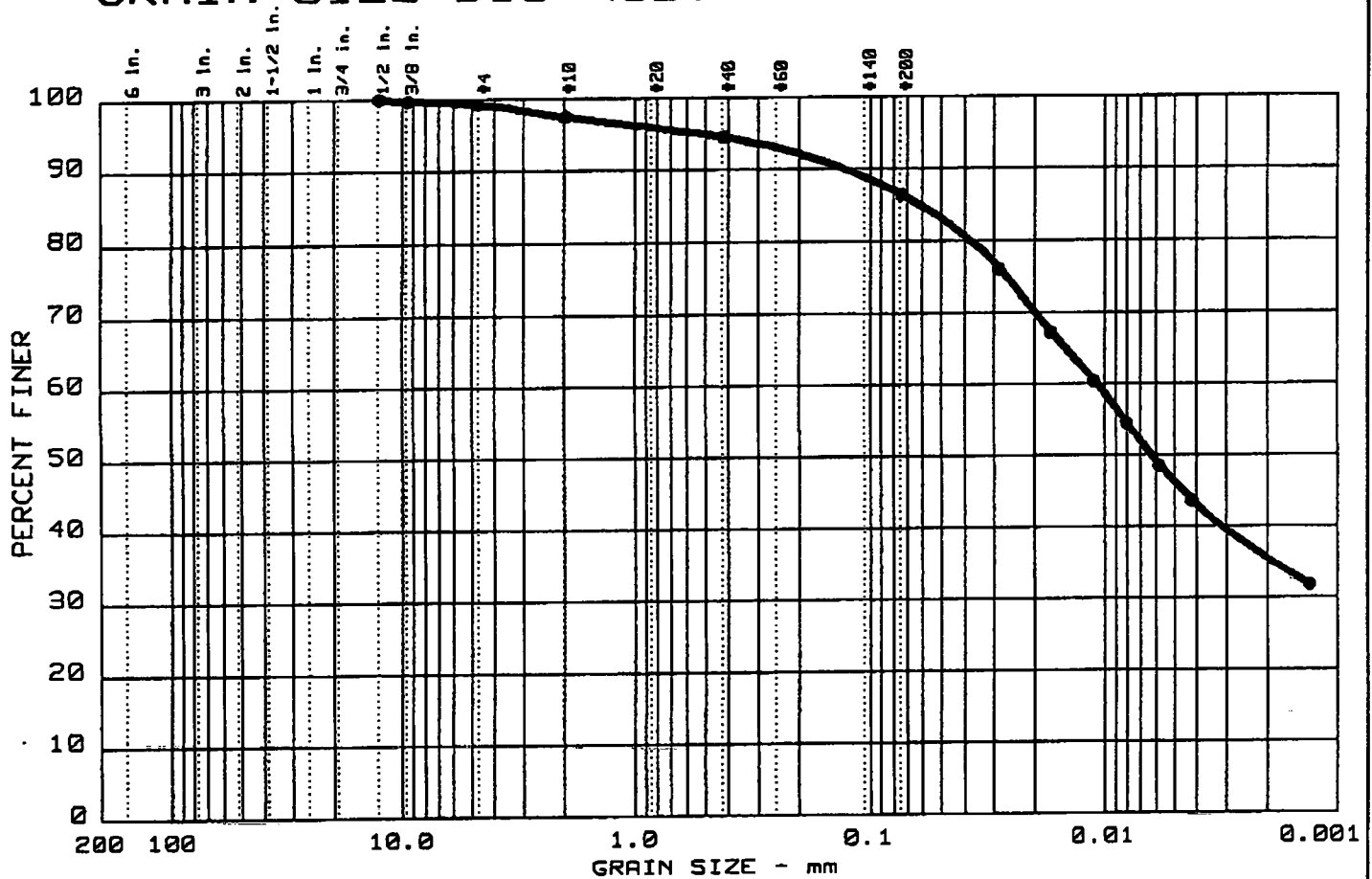
Date: 5-21-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
• 3	0.0	0.7	12.8	50.9	35.6	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
• 15.2	26	14	12.0	2.7					

MATERIAL DESCRIPTION	SAMPLE LOCATION
• Gray Silty Clay	• Sample No. 5-R

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

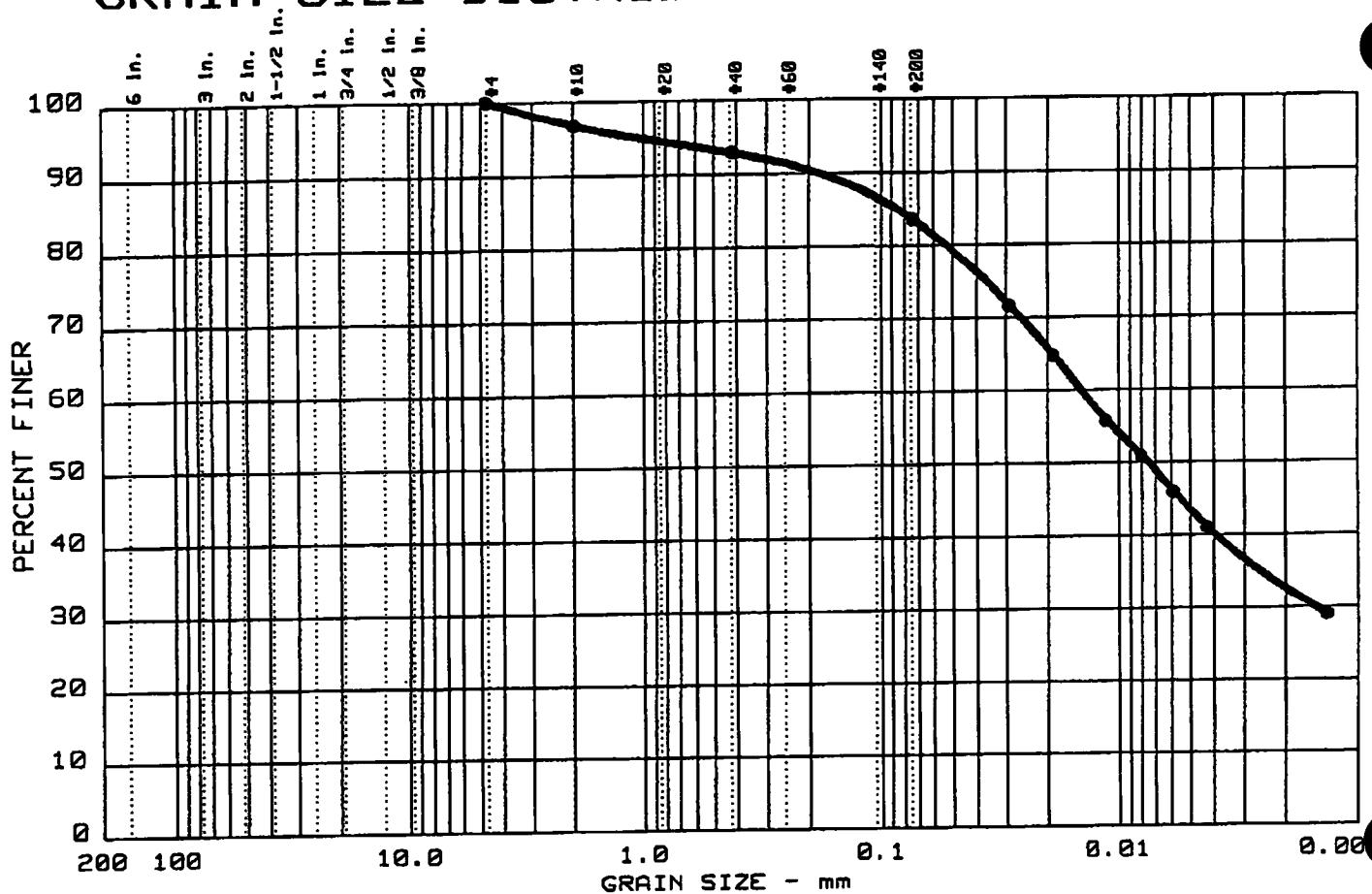
Date: 6-8-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
● 6	0.0	0.0	16.3	51.1	32.6	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
● 15.8	26	13	13.0	2.7		0.001			

MATERIAL DESCRIPTION	SAMPLE LOCATION
● Gray-Brown Silty Clay with Sand	● Sample No. 7-R

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

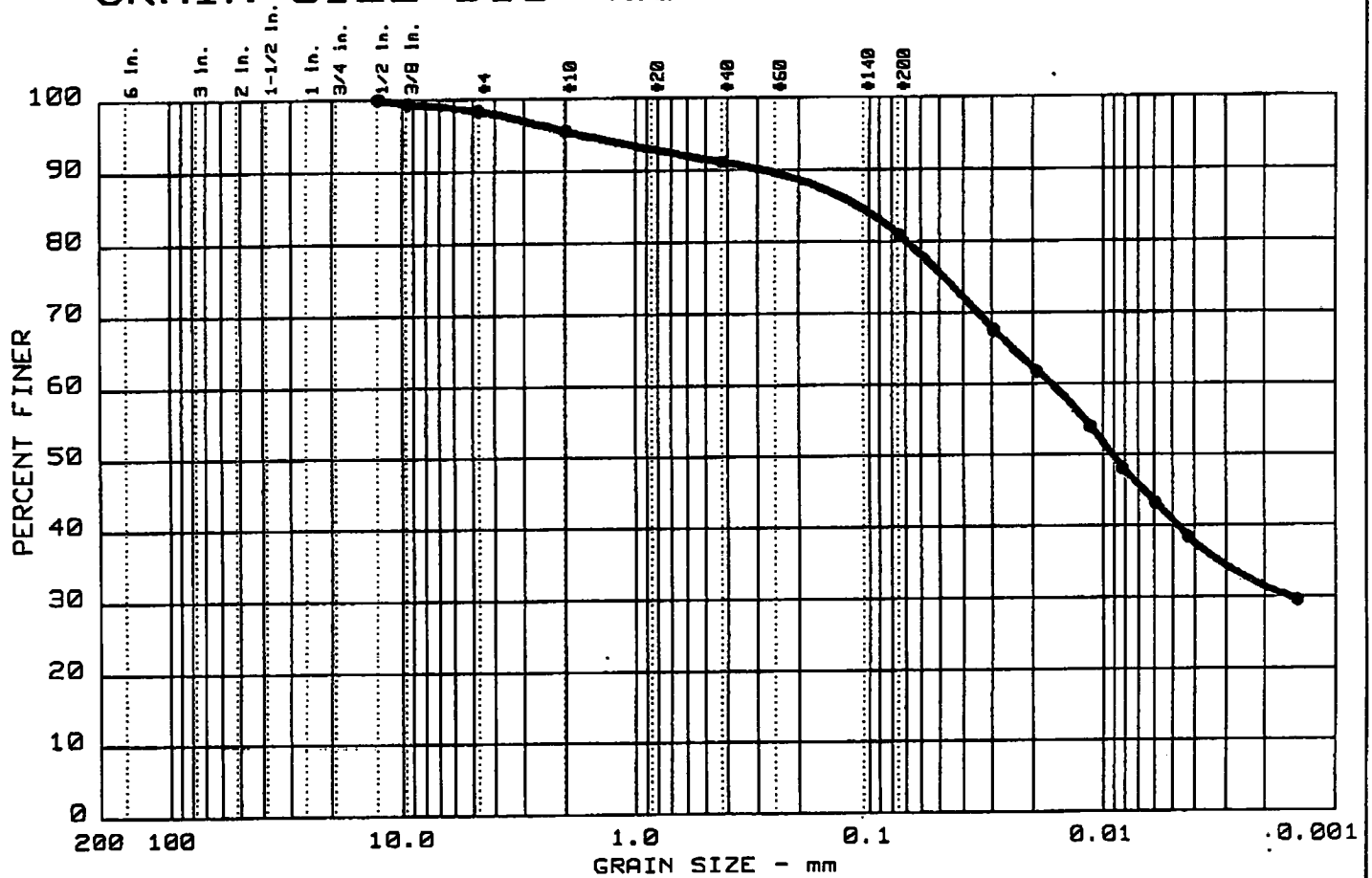
Date: 6-8-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
● 5	0.0	1.6	17.5	49.4	31.5	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
● 11.1	26	13	13.0	2.7		0.002			

MATERIAL DESCRIPTION	SAMPLE LOCATION
● Gray Silty Clay with Sand	● 5-U

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

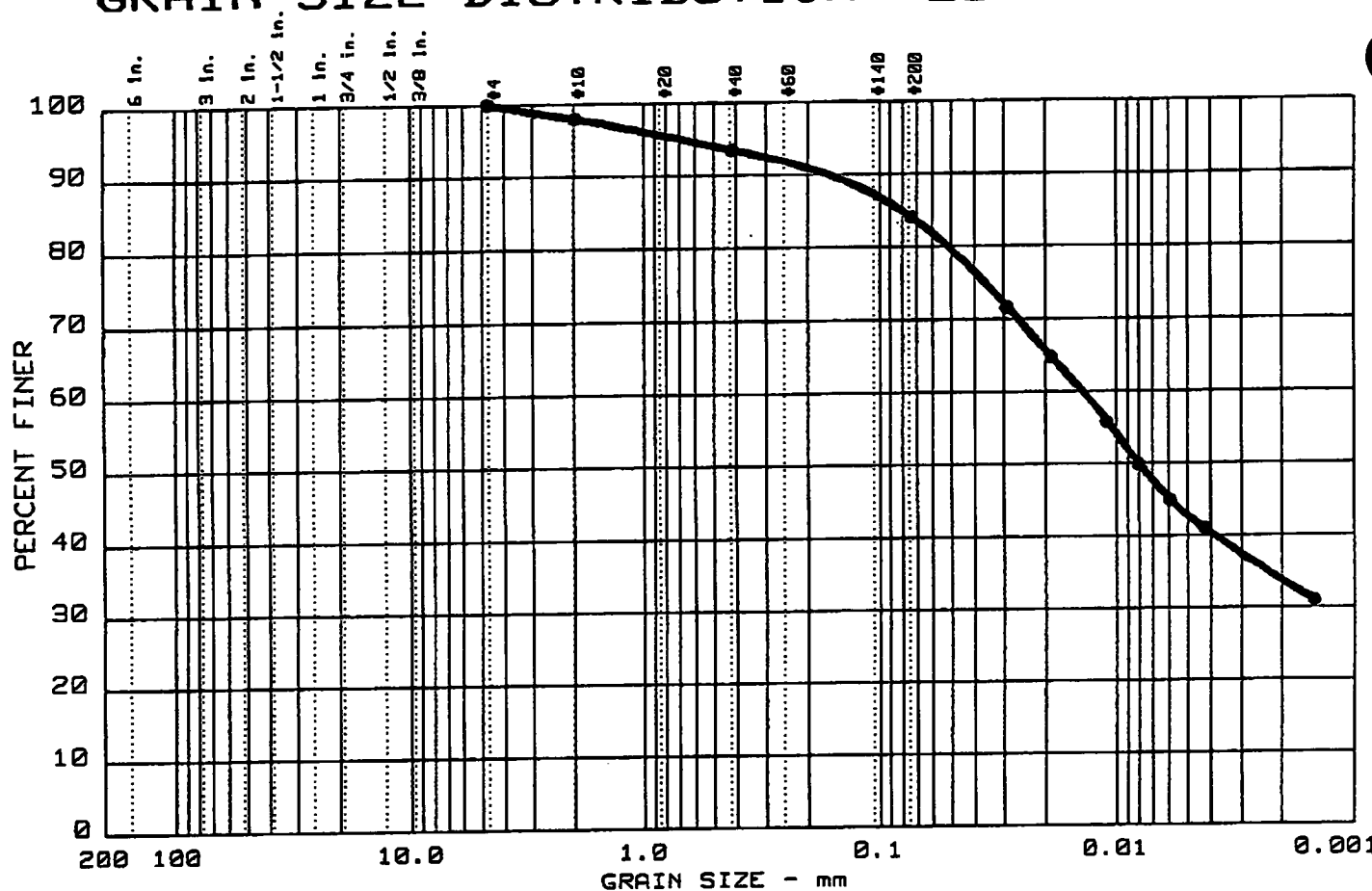
Date: 6-9-92

Giles Engineering Assoc., Inc.

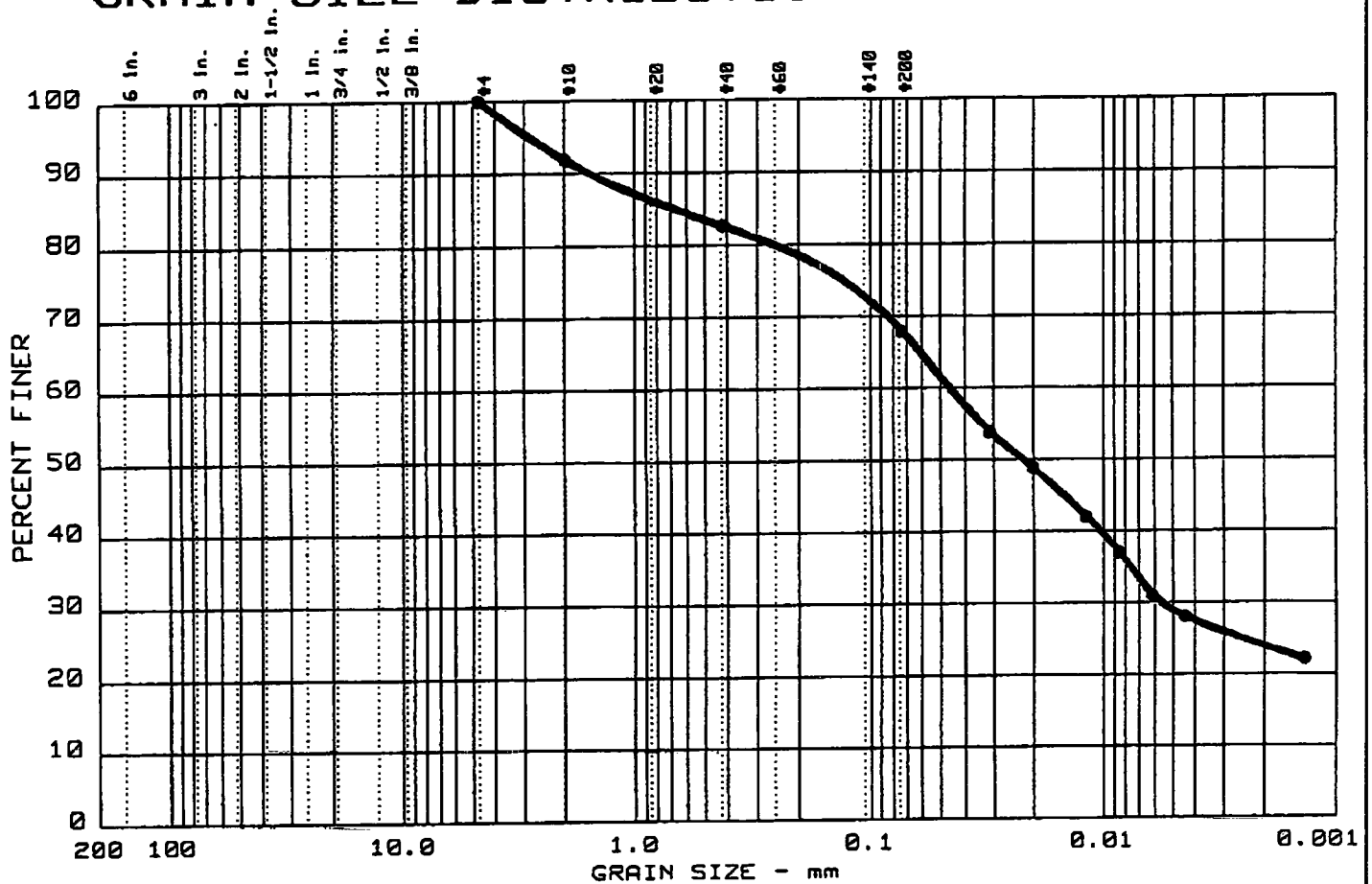
Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



GRAIN SIZE DISTRIBUTION TEST REPORT

[illegible][illegible]

MATERIAL DESCRIPTION	SAMPLE LOCATION
● Yellow-Brown Silty Clay with Sand	● Sample No. 9-R

Project No.: 1M-920436
Project: BFI-Zion Facility
Client: BFI Waste Systems

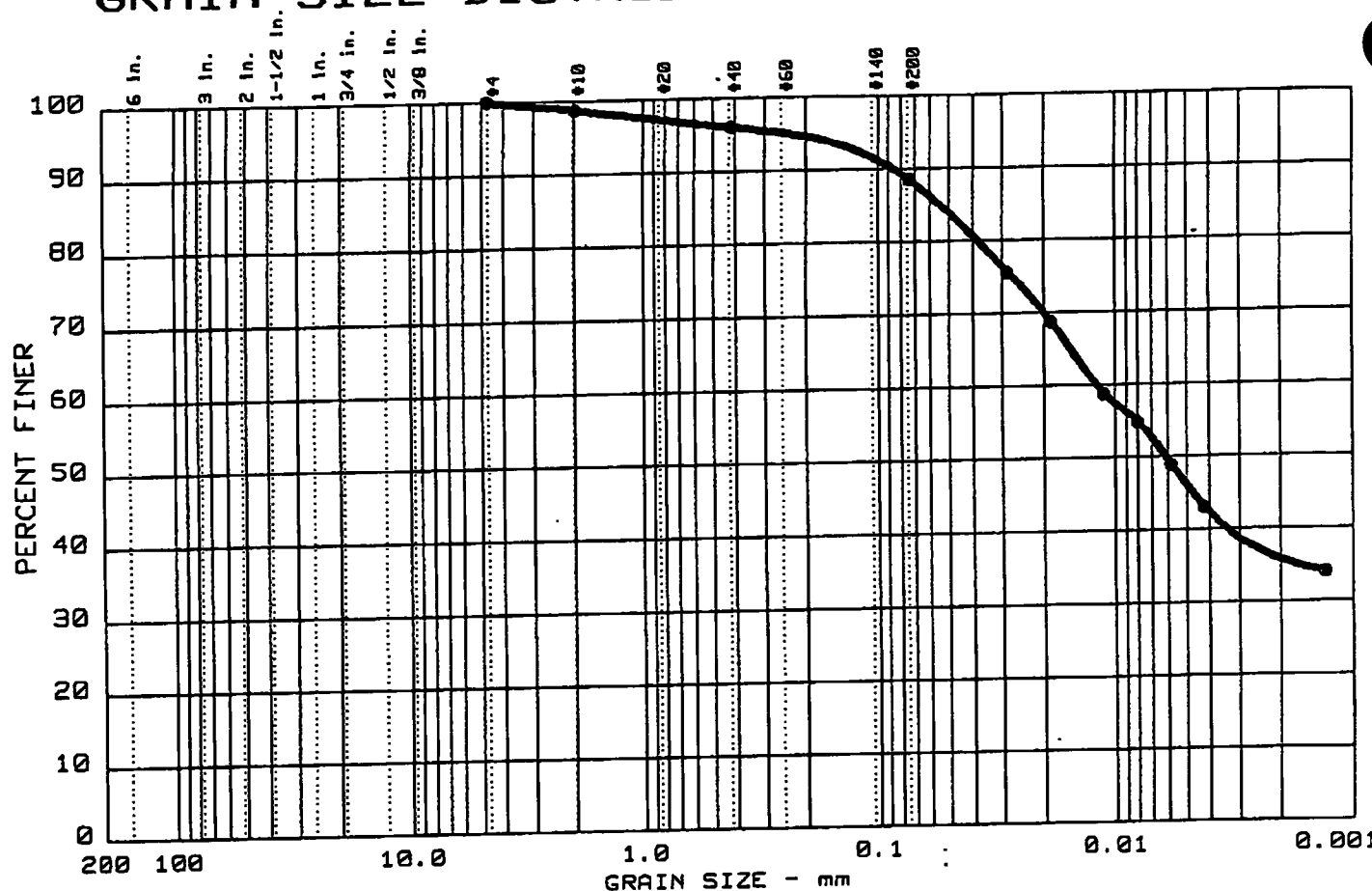
Date: 6-15-92

Giles Engineering Assoc., Inc.

Remarks :

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
1	0.0	0.0	11.4	52.7	35.9	CL	

NM	LL	PL	PI	Sp. Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
15.6	26	13	13.0	2.7					

MATERIAL DESCRIPTION	SAMPLE LOCATION
Gray-Brown Silty Clay	Sample No. 10-R

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems Inc.

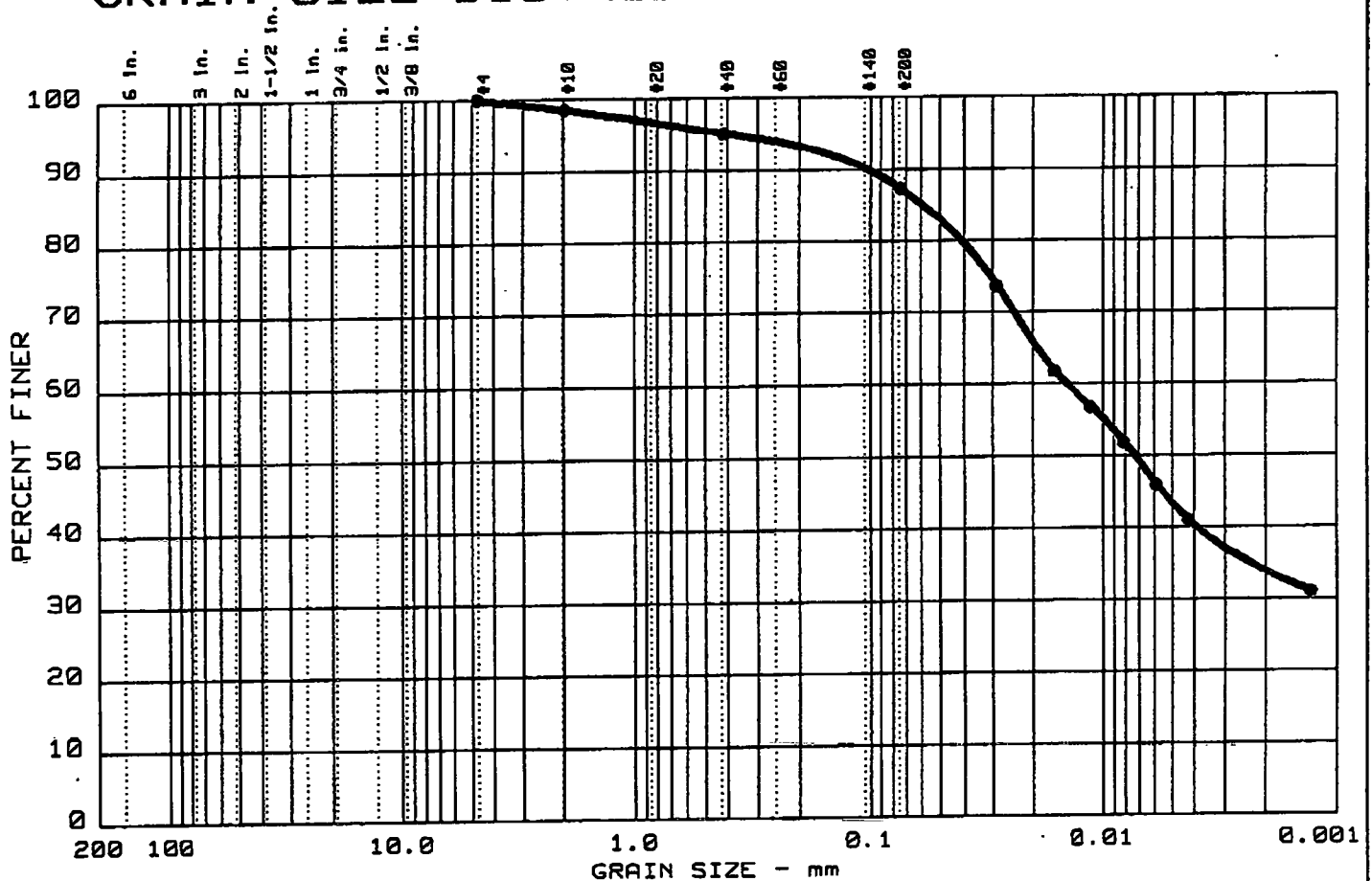
Date: 6-19-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
● 4	0.0	0.0	12.6	53.5	33.9	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	G _c	C _u
● 14.8	26	14	12.0	2.7					

MATERIAL DESCRIPTION	SAMPLE LOCATION
● Gray-Brown Silty Clay	● Sample No. 8-U

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems Inc.

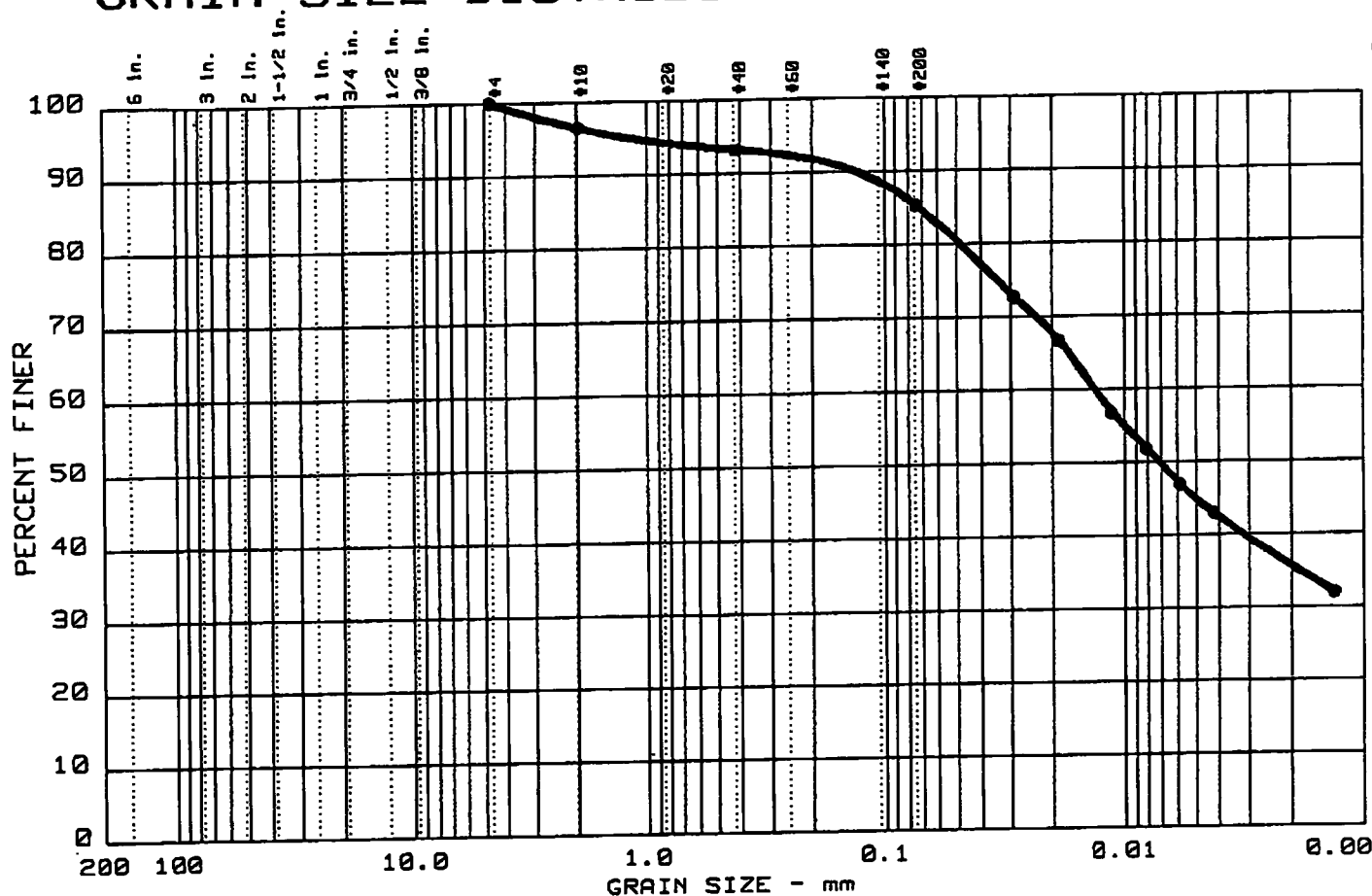
Date: 6-19-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
3	0.0	0.0	14.6	49.6	35.8	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
14.6	28	14	14.0	2.7					

MATERIAL DESCRIPTION	SAMPLE LOCATION
Gray-Brown Silty Clay	Sample No. 7-U

Project No.: 1M-920436
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

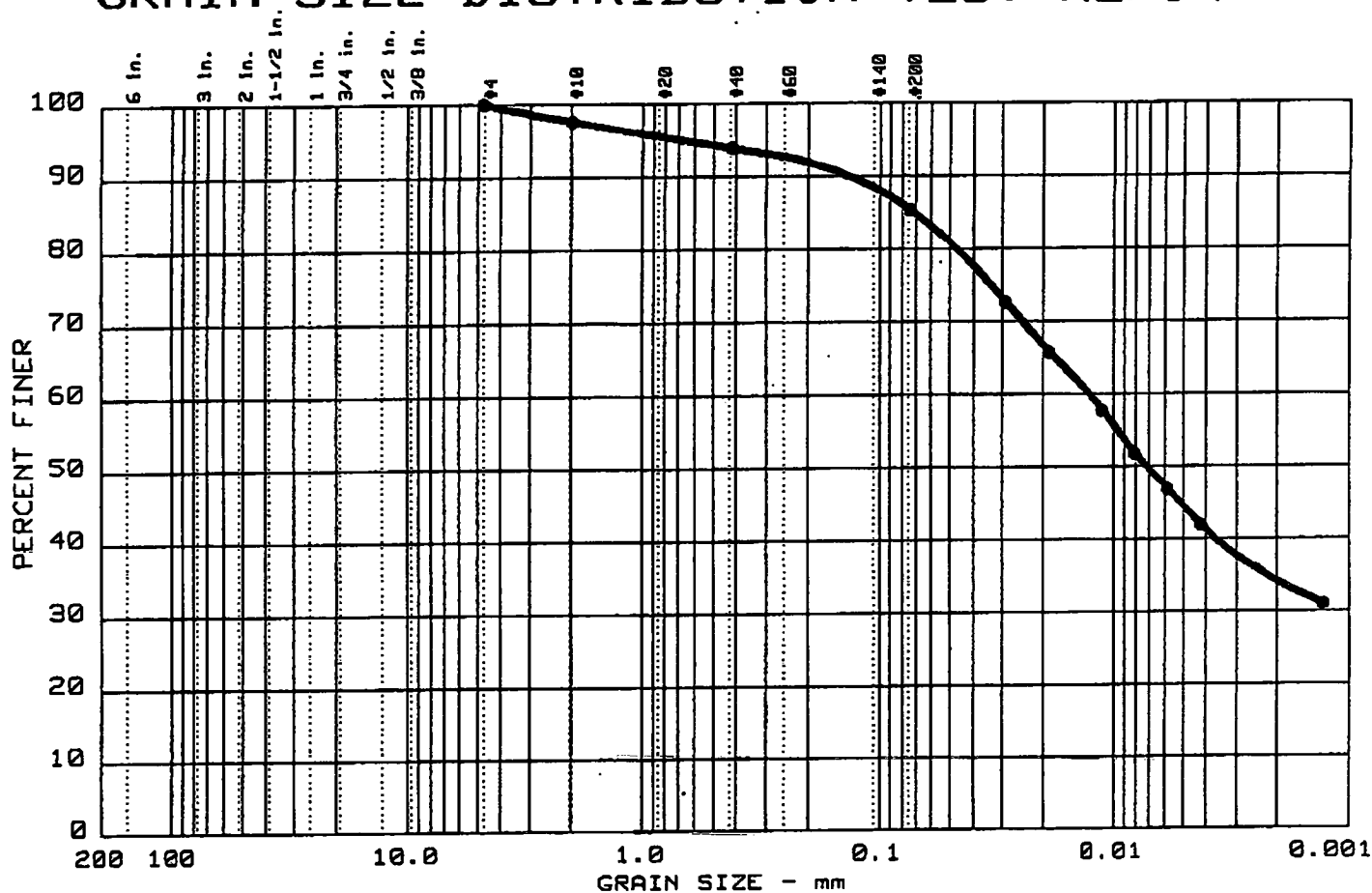
Date: 6-15-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT

[illegible][illegible]

MATERIAL DESCRIPTION	SAMPLE LOCATION
● Gray-Brown Silty Clay	● Sample No. 9-U

Project No.: 1M-920436
Project: BFI-Zion Facility
Client: BFI Waste Systems Inc.

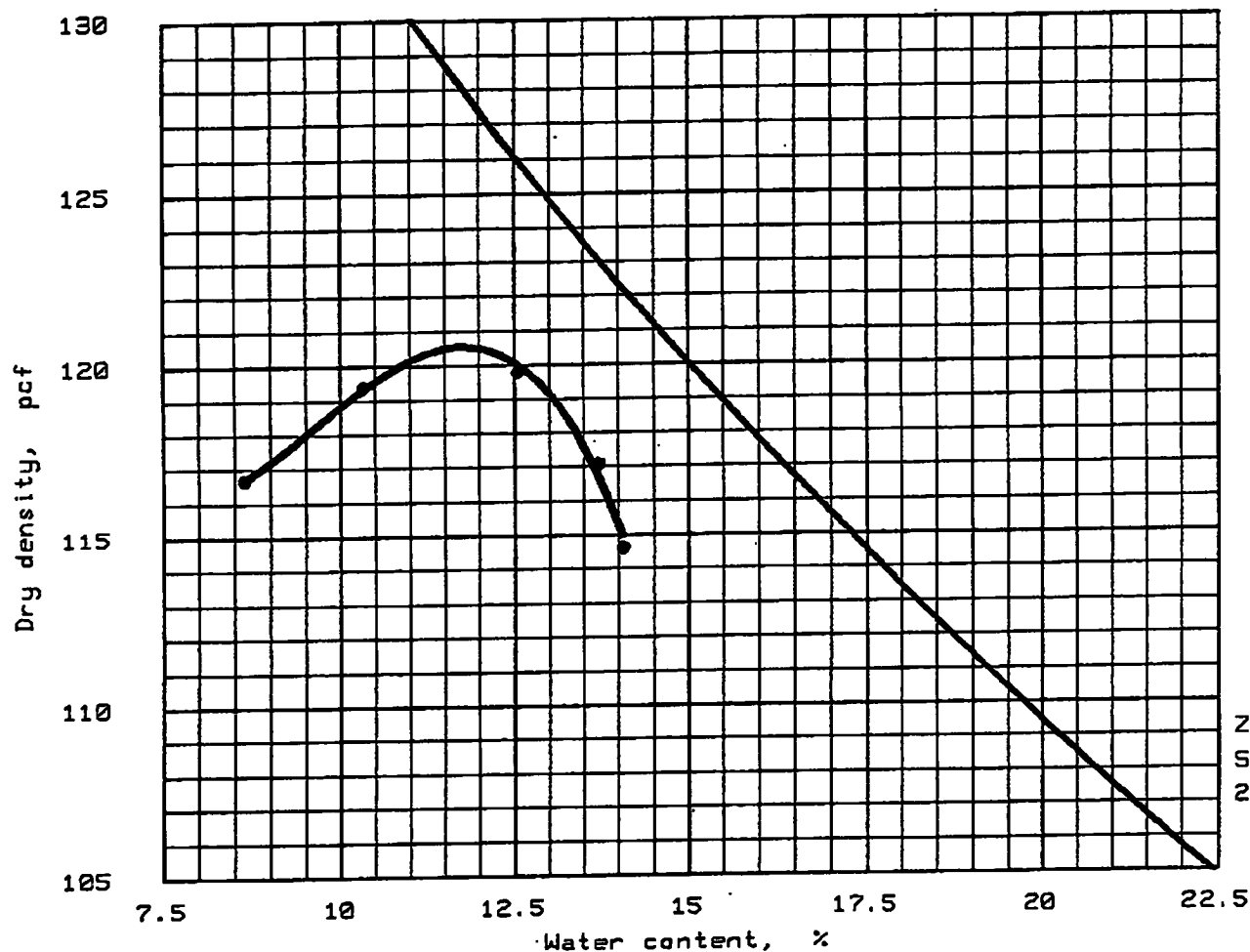
Date: 6-19-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No.

MOISTURE DENSITY RELATIONSHIP TEST REPORT



ZAV for
Sp.G. =
2.7

"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 120.6 pcf

Optimum moisture = 11.7 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
	CL		15.1 %	2.7				

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

1R Cell 1

Project No.: 1M-920436

Project: BFI-Zion Facility

Client: BFI Waste Systems

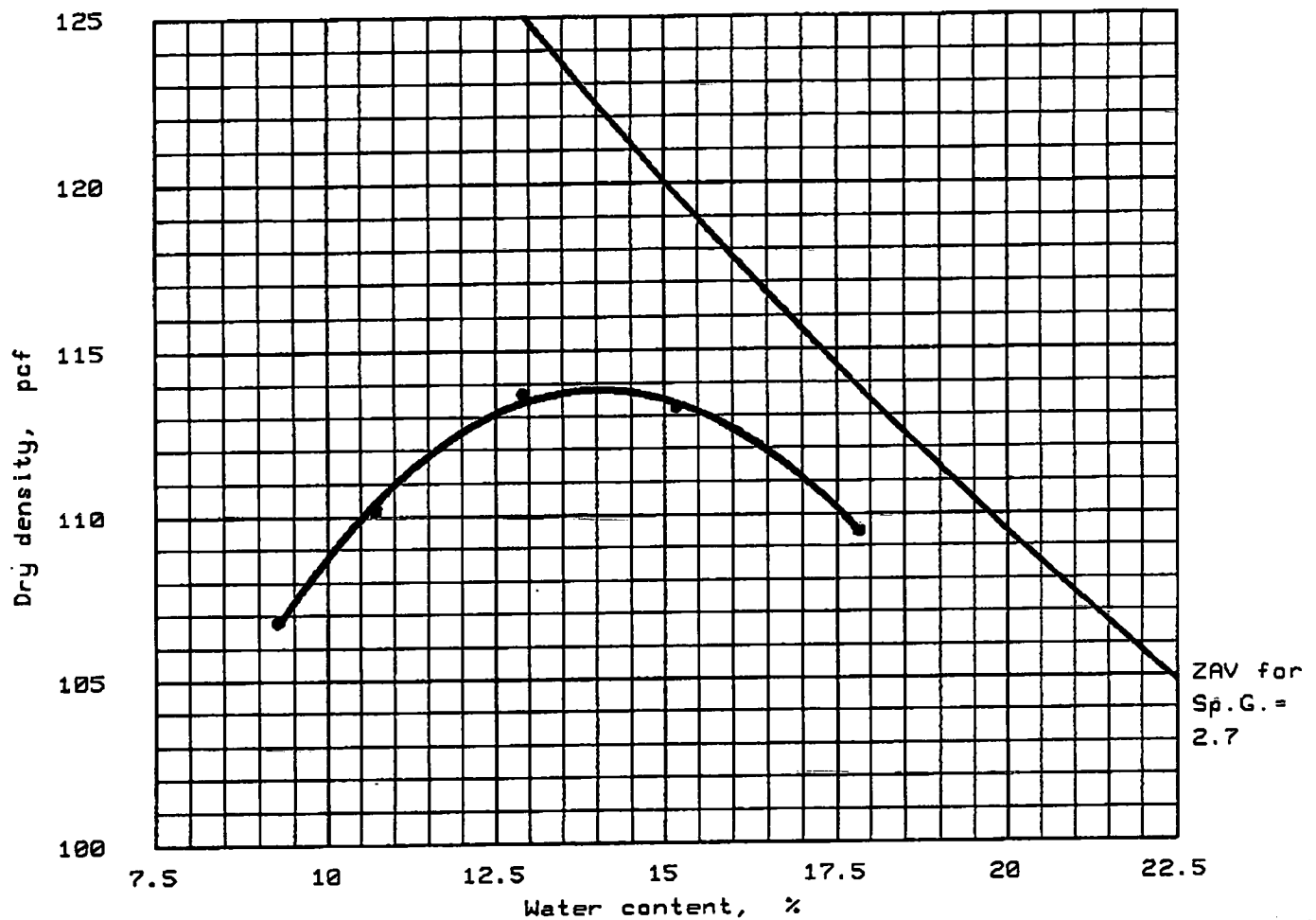
Date: 5-1-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 113.8 pcf

Optimum moisture = 14.0 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
	CL		11.7 %	2.7				

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

2R Cell 2

Project No.: 1M-920436

Project: BFI-Zion Facility

Client: BFI Waste Systems

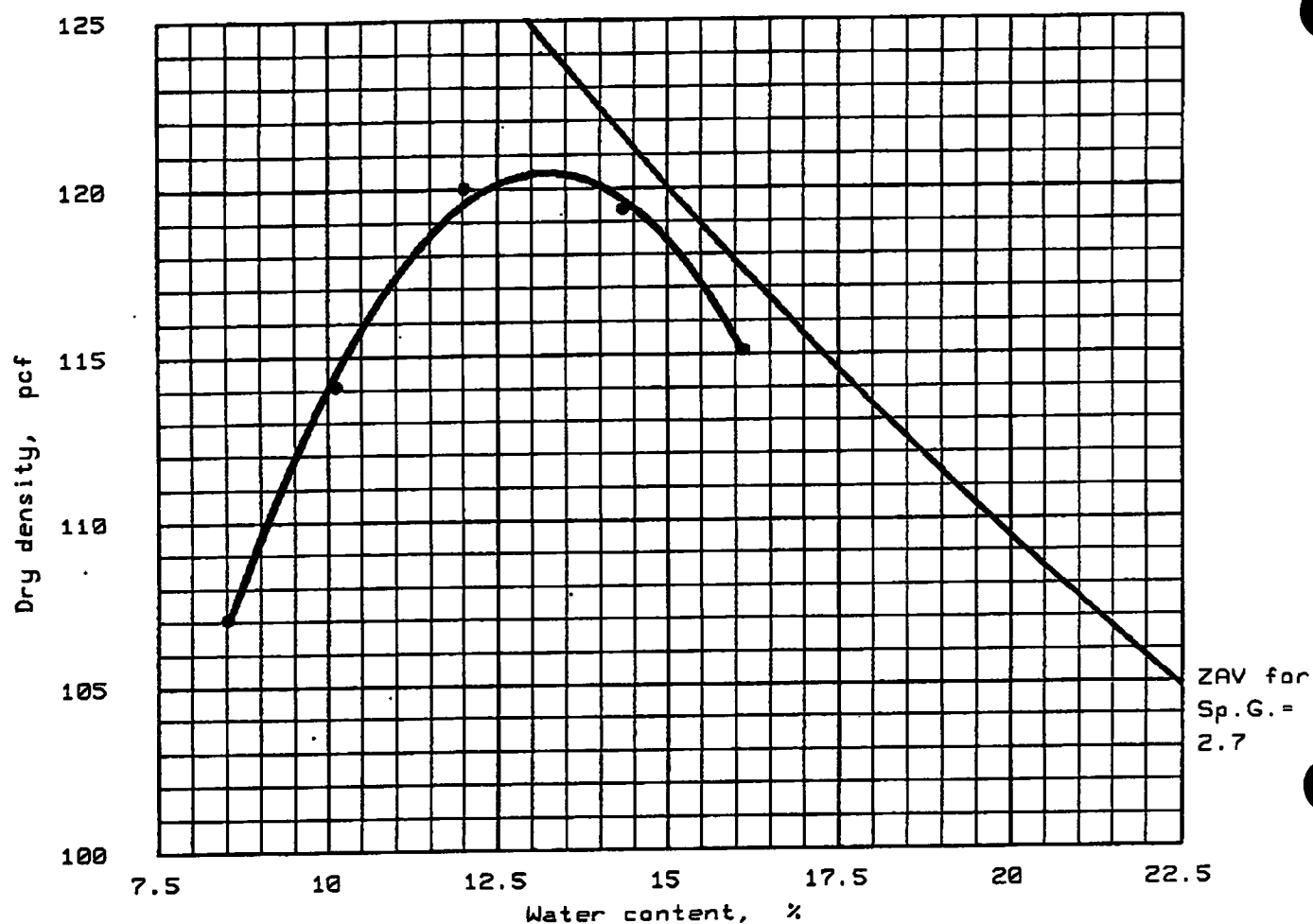
Date: 5-1-92

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 120.5 pcf

Optimum moisture = 13.2 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
	CL		15.4 %	2.7	29	14	2.3	82.8

MATERIAL DESCRIPTION

Gray-Brown Silty Clay
with Sand

SAMPLE LOCATION

3-R 117+00 East Edge

Project No.: 1M-920436

Project: BFI-Zion Facility

Client: BFI Waste Systems

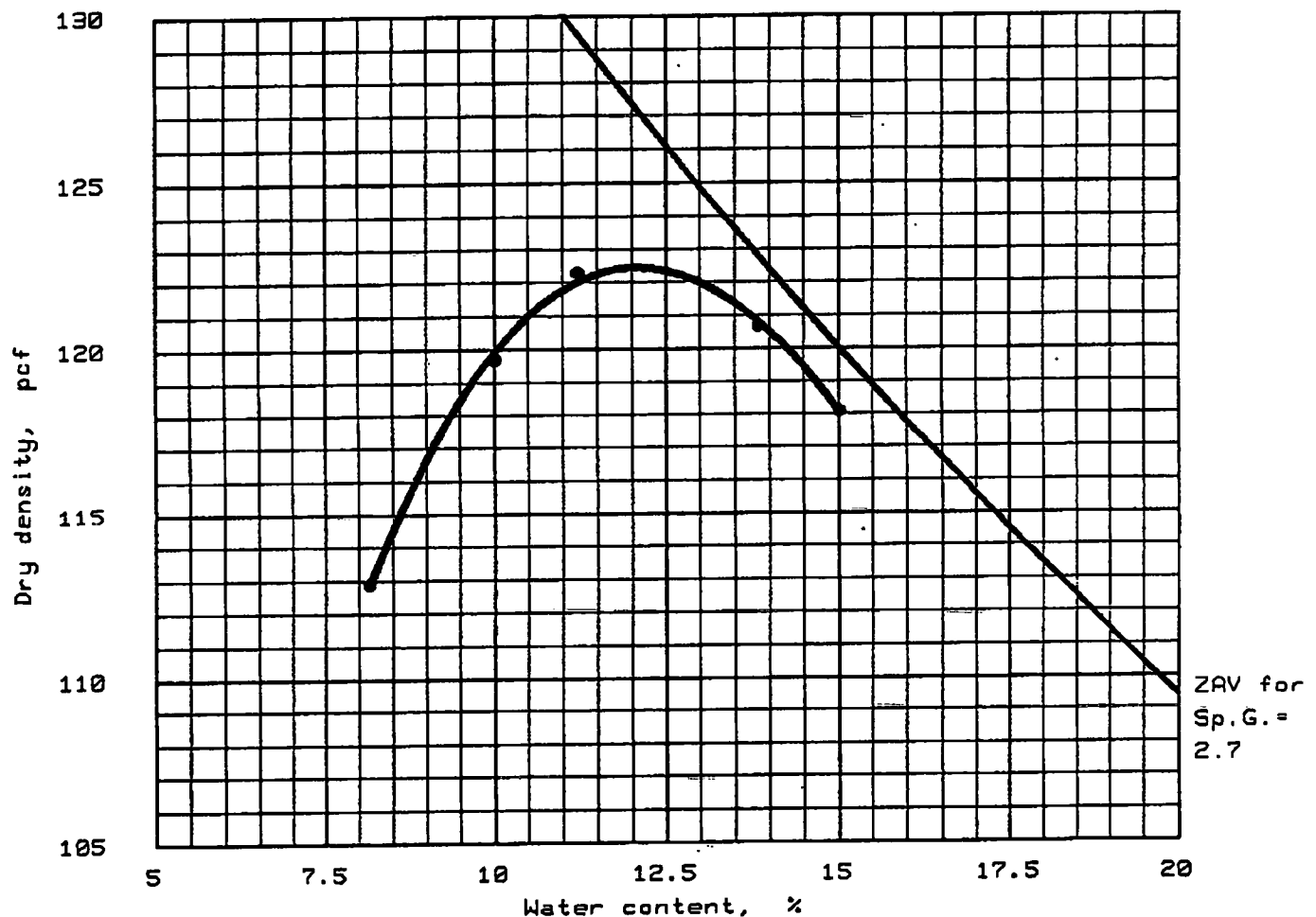
Date: 5-22-1992

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 122.5 pcf

Optimum moisture = 12.1 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
	CL		14.8 %	2.7	26	14	4.2	80.7

MATERIAL DESCRIPTION

Brown-Gray Silty Clay
with Sand

SAMPLE LOCATION

4-R 122+00 West Edge

Project No.: 1M-920436
Project: BFI-Zion Facility
Client: BFI Waste Systems

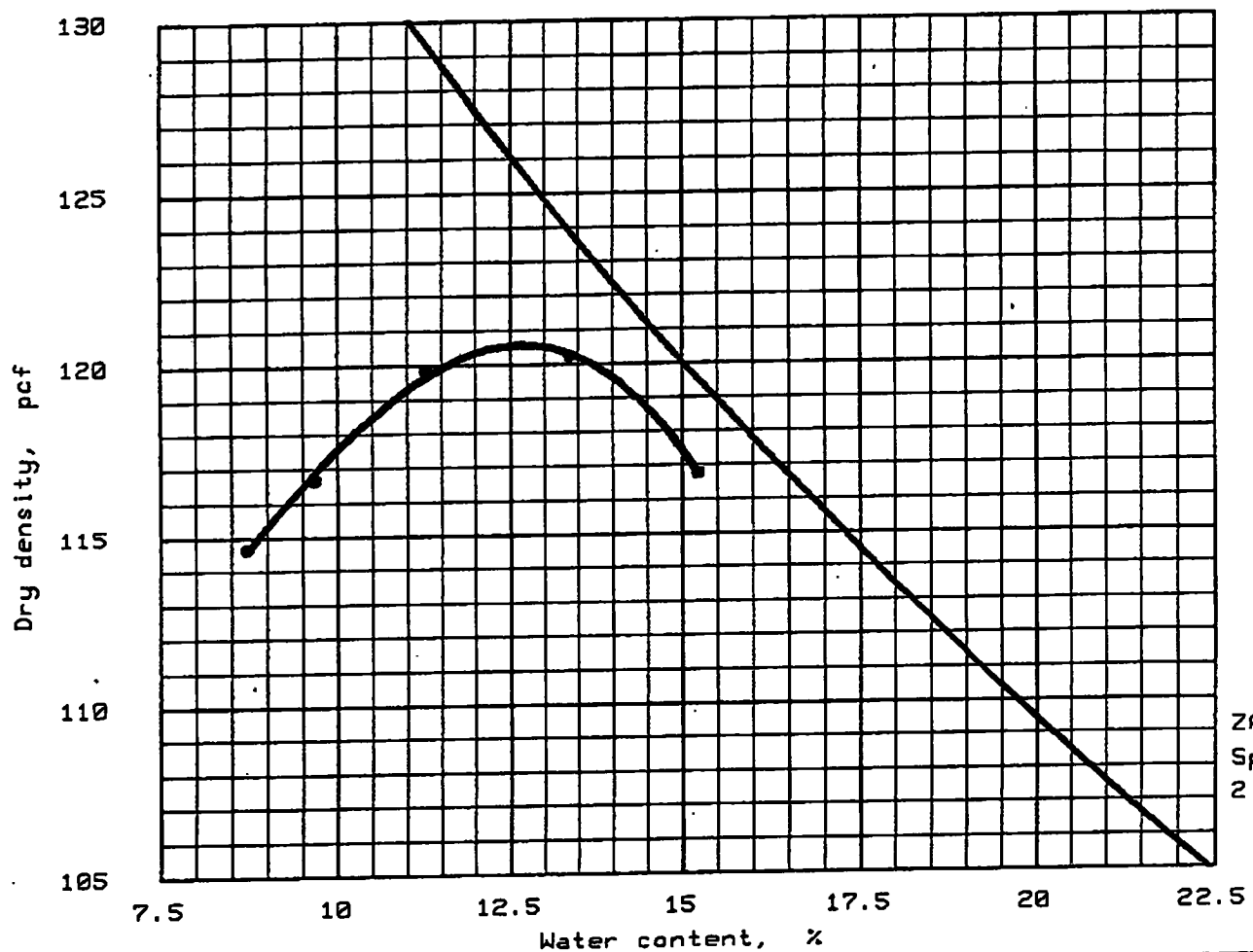
Date: 5-22-1992

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



ZAV for
Sp.G. =
2.7

"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 120.6 pcf

Optimum moisture = 12.7 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
SR	CL		15.2 %	2.7	26	12	0.7 %	86.5 %

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay with Sand

N116+00 E93+75 Lift 4

Project No.: 1M-920436
Project: BFI-Zion Facility
Client: BFI Waste Systems

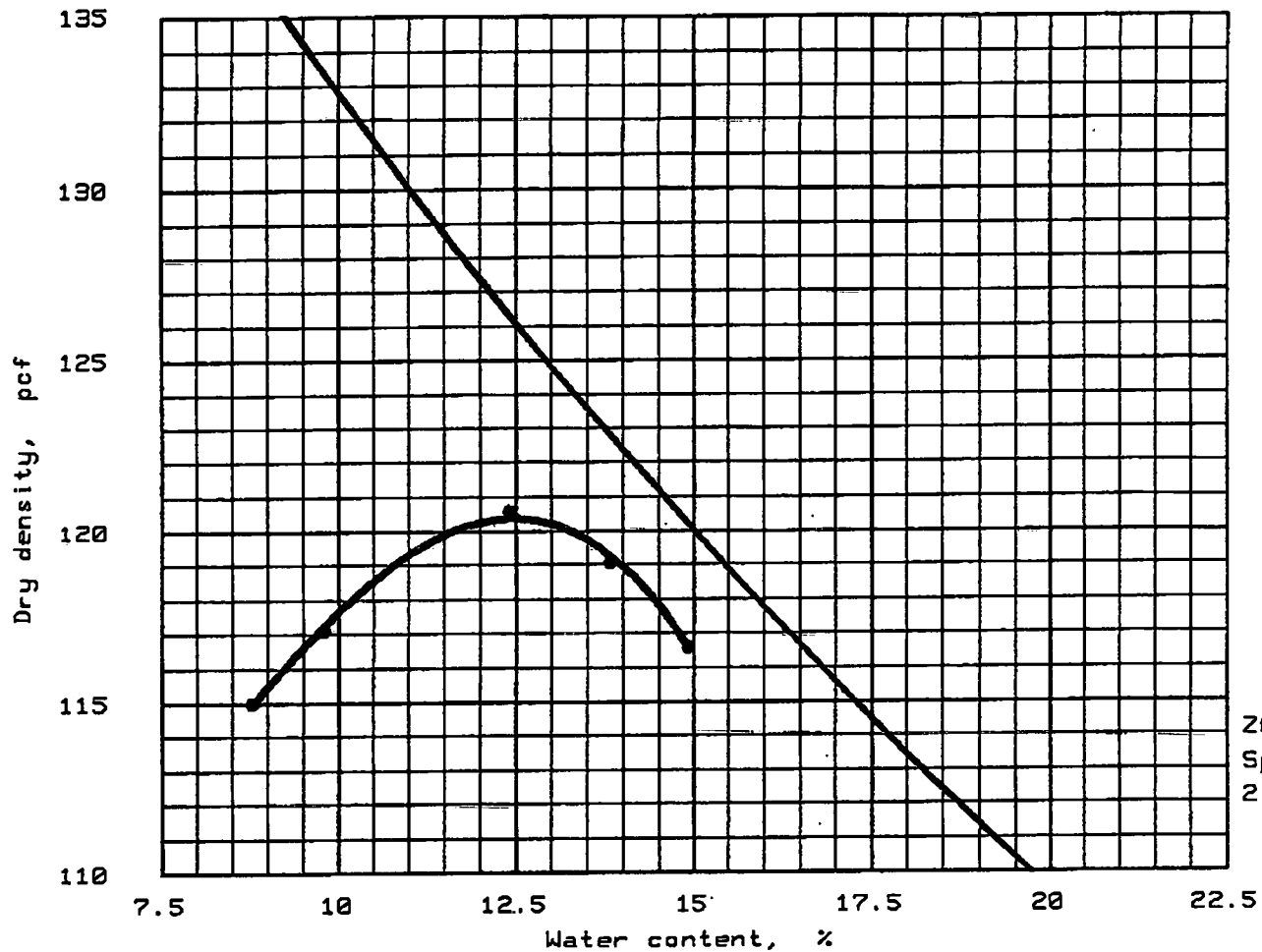
Remarks:

Date: 6-16-1992

Giles Engineering Assoc., Inc.

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 120.4 pcf

Optimum moisture = 12.4 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
G-R	CL		14.3 %	2.7	25	12	1.3	83.6

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay

N112+00N E93 + 75
Sample No. 6R

Lift 6

Project No.: 1M-920436
Project: BFI-Zion Facility
Client: BFI Waste Systems

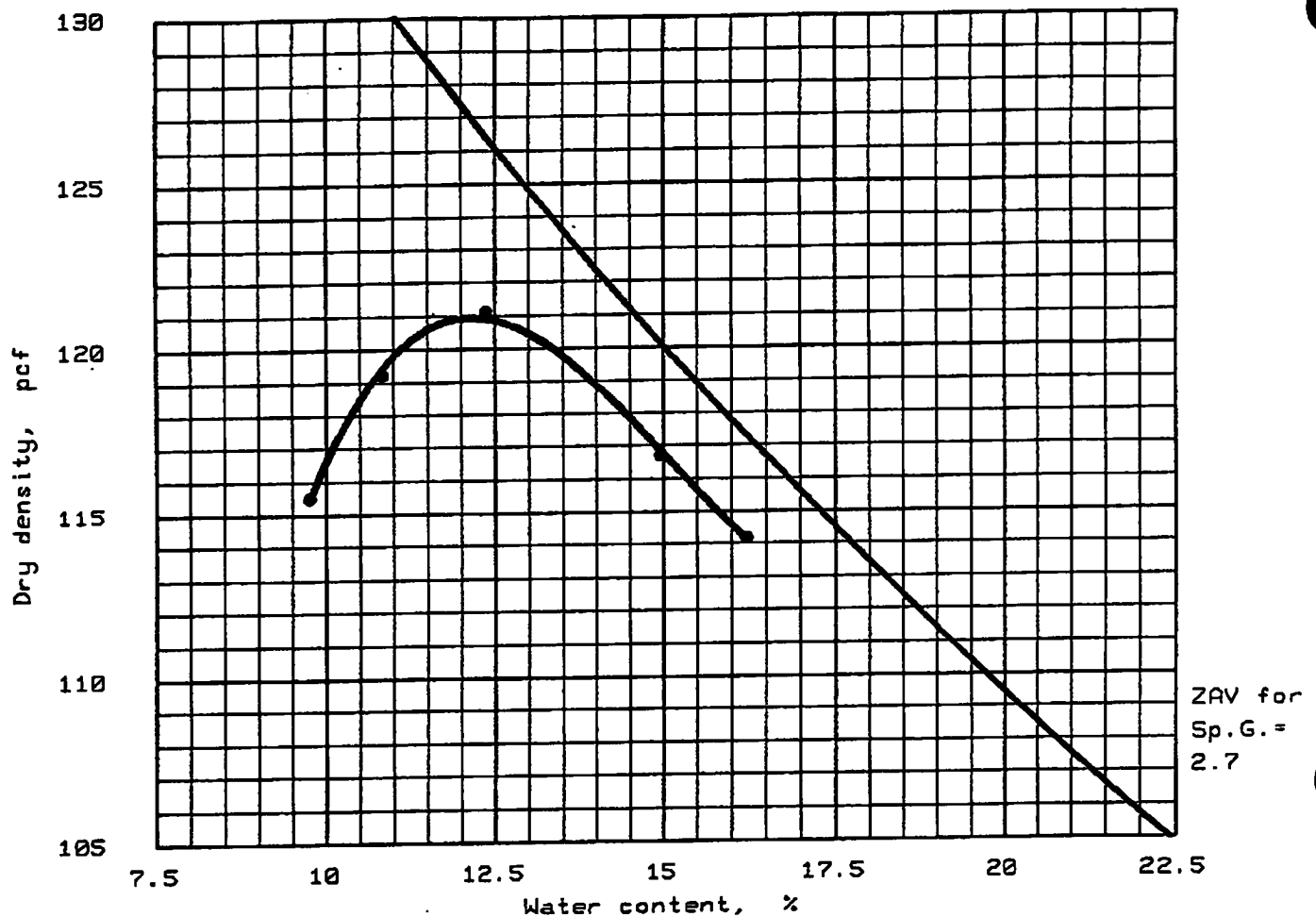
Remarks:

Date: 5-29-1992

Giles Engineering Assoc., Inc.

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 121.0 pcf

Optimum moisture = 12.1 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
7-R	CL		15.8 %	2.7	26	13	0.0	83.7

MATERIAL DESCRIPTION

Gray-Brown Silty Clay

SAMPLE LOCATION

N116+50 E93+75
Sample No. 7R

Project No.: 1M-920436
Project: BFI-Zion Facility
Client: BFI Waste Systems

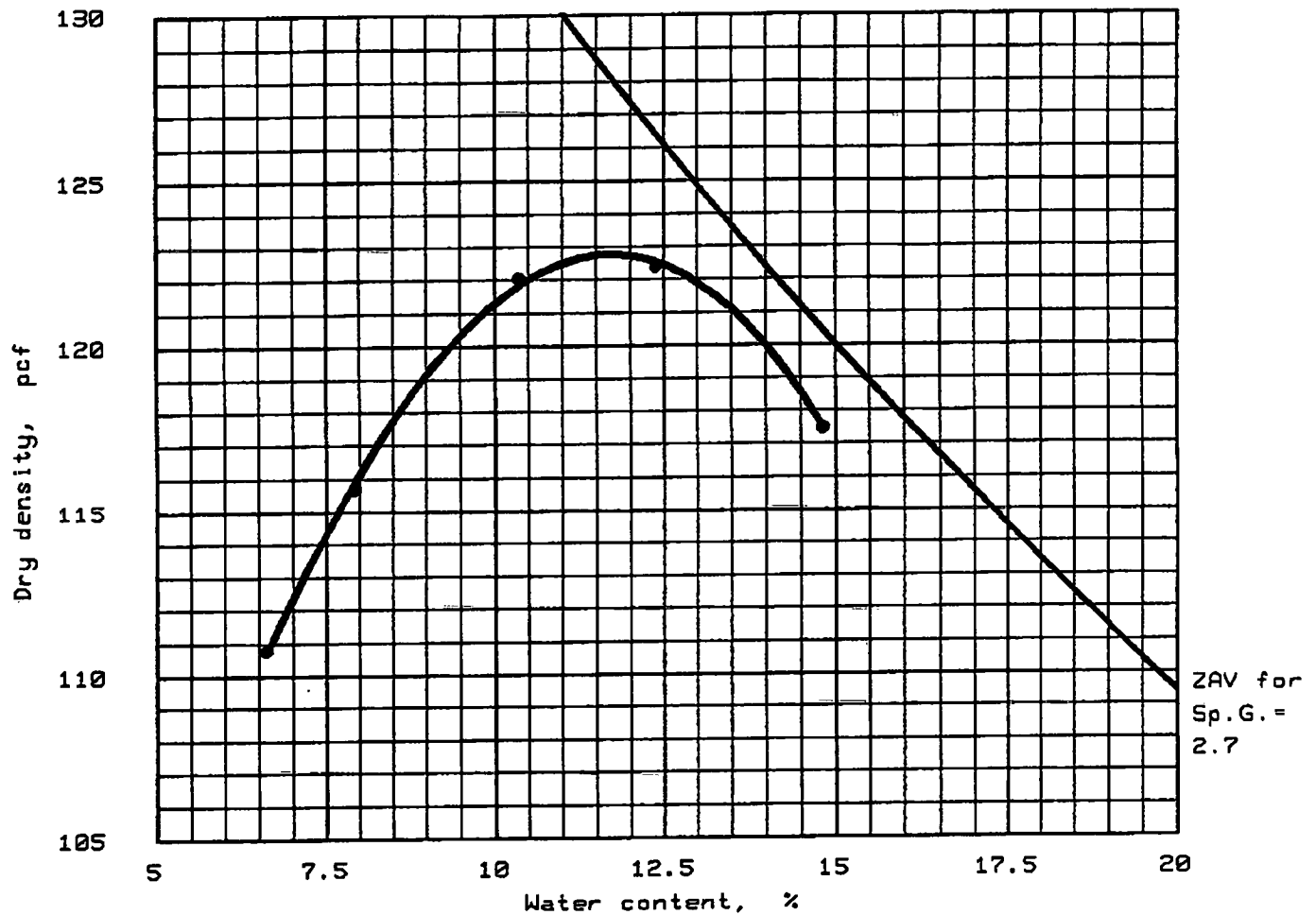
Date: 5-29-1992

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 122.8 pcf

Optimum moisture = 11.7 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
B-R	CL		15.8 %	2.7	27	14	0.0 %	84.2 %

MATERIAL DESCRIPTION

Gray-Brown Silty Clay
with Sand

SAMPLE LOCATION

N109+50 E93+75 Lift 10
Sample No: 8-R

Project No.: 1M-920436
Project: BFI-Zion Facility
Client: BFI Waste Systems

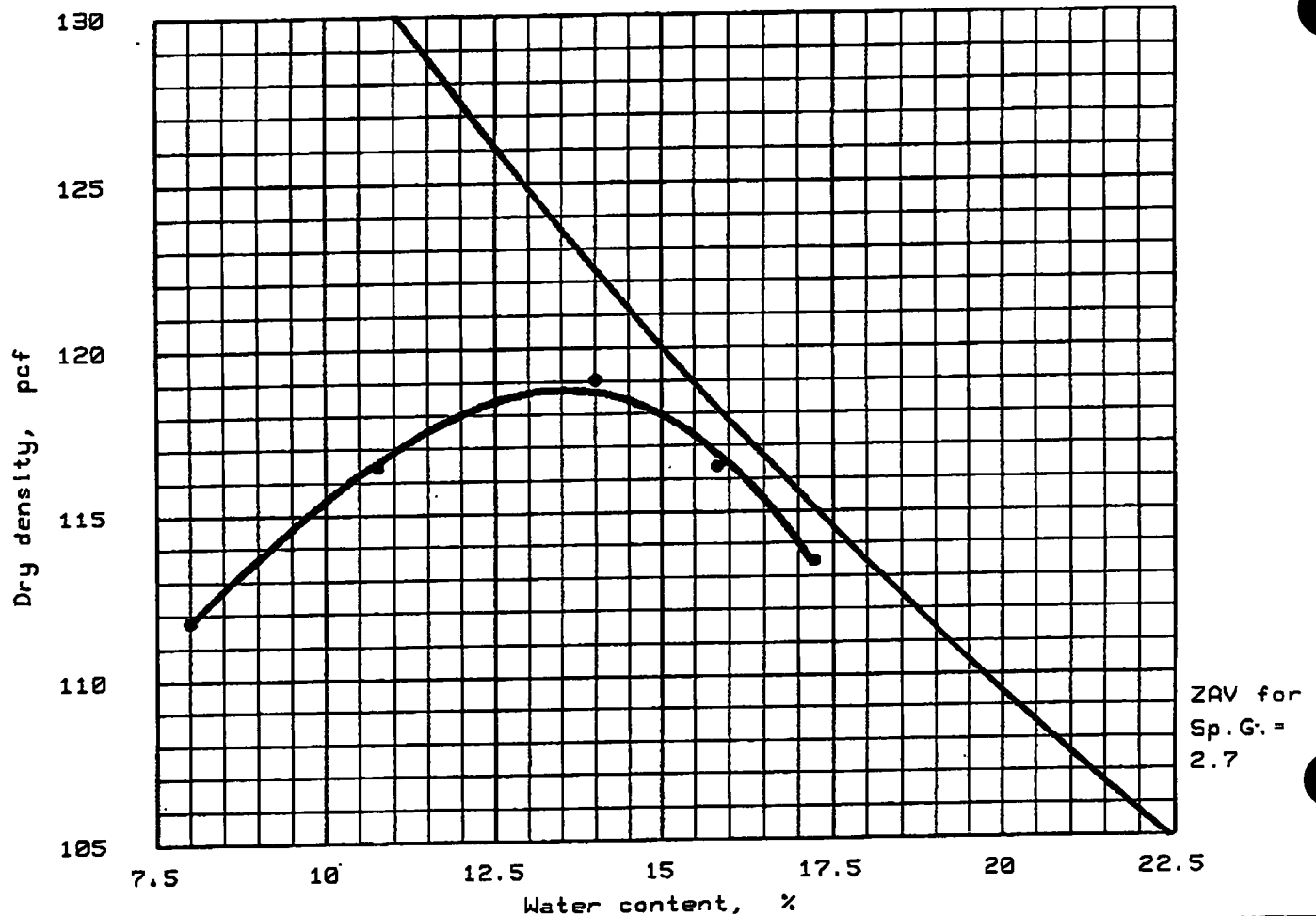
Date: 6-09-1992

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 118.8 pcf

Optimum moisture = 13.5 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
9R	CL		19.8 %	2.7	26	11	0.0 %	68.0 %

MATERIAL DESCRIPTION

Gray Silty Clay with Sand

SAMPLE LOCATION

Barrow Site

Project No.: 1M-920436
Project: BFI-Zion Facility
Client: BFI Waste Systems

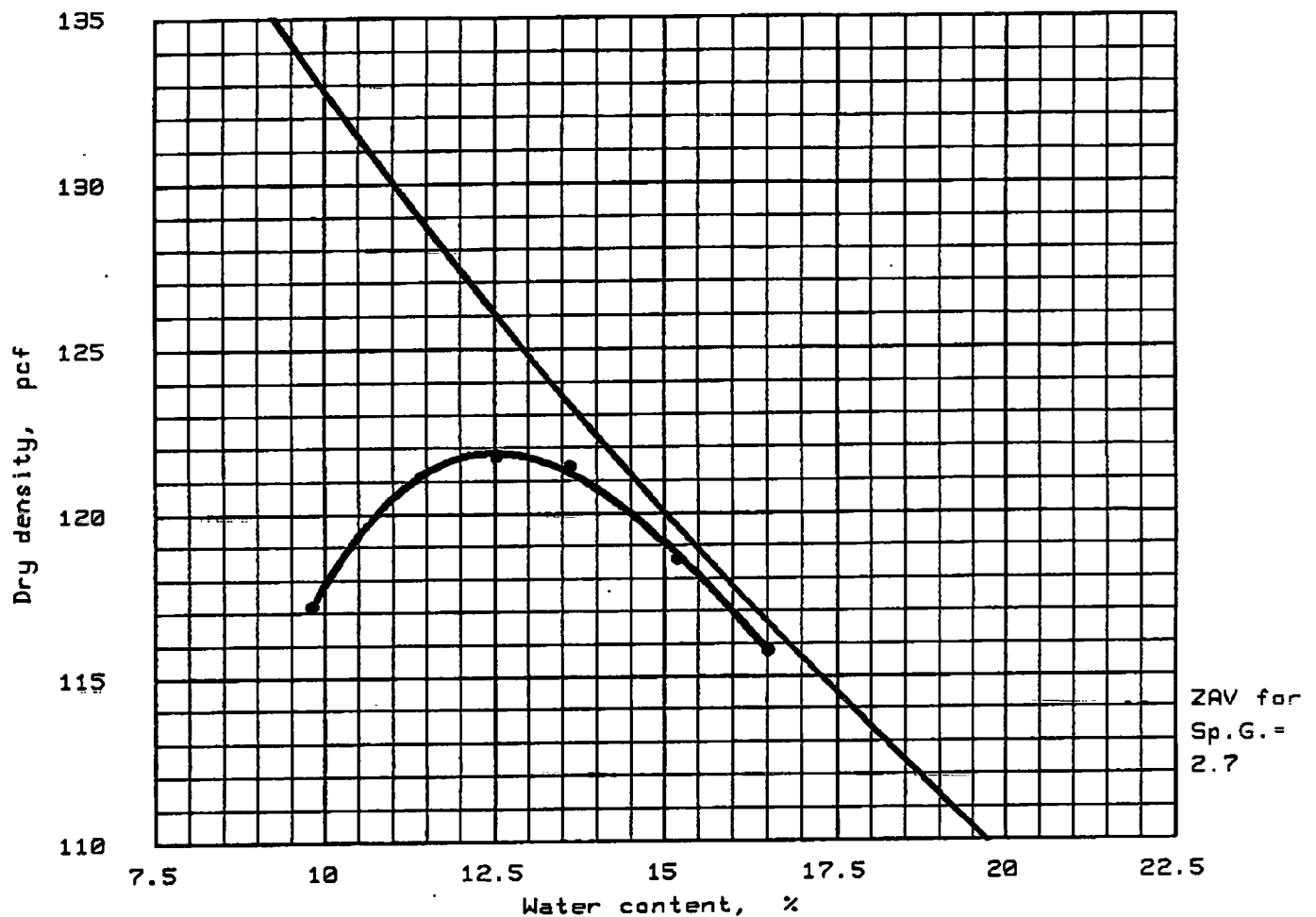
Date: 6-16-1992

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 121.9 pcf

Optimum moisture = 12.5 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
10-R	CL		15.6 %	2.7	26	13	0.0 %	88.6 %

MATERIAL DESCRIPTION

Gray Silty Clay with Sand

SAMPLE LOCATION

N119+00 Lift 11
Borrow Pit

Project No.: 1M-920436
Project: BFI-Zion Facility
Client: BFI Waste Systems Inc.

Date: 6-19-1992

Giles Engineering Assoc., Inc.

Remarks:

Figure No. _____

SAMPLE HEIGHT (L),in:	2.6	MEMBRANE TYPE:	Latex, 0.025"
SAMPLE DIAMETER (D),cm:	7.24	PERMEANT FLUID:	Distilled, Deaired water
SAMPLE AREA (A),sq. cm:	41.16	CONSOLIDATION PRESSURE,psi:	7
		B PARAMETER:	0.92
		HYDRAULIC GRADIENT (H),psi:	10

CLOCK TIME 5-20,5-22	TIME (T) (min)	BURETTE lower	CHANGE upper	FLOW (Q) (ml)	PERMEABILITY(cm/s)= Q/T[0.0006L/A*H]
5:10	245	0.4	0.3	0.35	5.4 x 10E-9
7:50	880	1.3	1.3	1.3	5.6 x 10E-9
1:10	320	0.4	0.5	0.45	5.3 x 10E-9
4:40	210	0.3	0.3	0.3	5.4 x 10E-9
7:10	870	1.3	1.3	1.3	5.7 x 10E-9

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
13.0	122.7	84.1	30.9	28	15	13	-----	-----

SAMPLE LOCATION

117+00 East Edge

Sample 1U

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

GILES ENGINEERING ASSOCIATES, INC.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.25	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.98
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 5-30, 6-2	TIME (T) (min)	BURETTE CHANGE lower	upper	FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T [0.0006L/A \cdot H]$
12:30	1170	7.7	7.3	7.5	$2.1 \times 10E-8$
9:40	2710	10.1	10.2	10.15	$1.2 \times 10E-8$
1:45	215	0.8	0.8	0.8	$1.2 \times 10E-8$
5:00	225	0.8	0.8	0.8	$1.2 \times 10E-8$
7:15	855	2.8	3.0	2.9	$1.1 \times 10E-8$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 1 \times 10E-8$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
14.3	114.4*	83.6	32.0	25	12	13	120.4	12.4

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Separation Berm Sample 6R
N112+00 E93+75 Lift 6

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.15	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.94
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 5-27, 5-29	TIME (T) (min)	BURETTE CHANGE lower upper		FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T[0.0006L/A \cdot H]$
4:50	260	0.7	0.8	0.75	$9.0 \times 10E-9$
7:50	900	2.8	2.6	2.7	$9.4 \times 10E-9$
1:20	330	1.0	1.1	1.05	$9.9 \times 10E-9$
4:45	205	0.6	0.6	0.6	$9.2 \times 10E-9$
2:05	860	2.6	2.6	2.6	$9.5 \times 10E-9$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 9 \times 10E-9$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
13.9	---	---	---	--	--	--	----	----

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Separation Berm Sample 3U
N111+00 E93+75 Lift 5

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.3	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 2.85	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.94
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 5-27, 5-29	TIME (T) (min)	BURETTE CHANGE lower upper		FLOW (Q) (ml)	PERMEABILITY (cm/s) = Q/T [0.0006L/A*H]
4:50	260	1.8	1.7	1.75	2.3 x 10E-8
7:50	900	5.8	5.9	5.85	2.2 x 10E-8
1:20	330	2.1	2.05	2.075	2.1 x 10E-8
4:45	205	1.3	1.25	1.275	2.1 x 10E-8
7:05	855	5.7	5.6	5.65	2.2 x 10E-8

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 2 \times 10E-8$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
13.1	119.2	80.8	29.7	27	14	13	----	----

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Separation Berm Sample 4U
N115+00 E93+75 Lift 6

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.2	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.96
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 5-30, 6-2	TIME (T) (min)	BURETTE lower	CHANGE upper	FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T[0.0006L/A \cdot H]$
12:30	1170	7.4	7.2	7.3	$2.0 \times 10E-8$
9:40	2710	9.9	10.05	9.975	$1.2 \times 10E-8$
1:15	215	0.8	0.75	0.775	$1.2 \times 10E-8$
5:00	225	0.7	0.8	0.75	$1.1 \times 10E-8$
7:15	855	2.9	2.9	2.9	$1.1 \times 10E-8$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 1 \times 10E-8$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
11.1	---	80.9	31.5	26	13	13	----	----

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay

Separation Berm Sample 5U
N108+00 E93+75 Lift 8

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.4	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.96
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 5-30, 6-2	TIME (T) (min)	BURETTE lower	CHANGE upper	FLOW (Q) (ml)	PERMEABILITY (cm/s) = Q/T [0.0006L/A*H]
1:15	215	1.3	1.3	1.30	2.1 X 10E-8
5:00	225	1.3	1.2	1.25	1.9 X 10E-8
7:15	855	4.3	4.4	4.35	1.8 X 10E-8
11:30	255	1.3	1.3	1.30	1.8 X 10E-8
4:30	300	1.4	1.5	1.45	1.7 X 10E-8

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 2 \times 10E-8$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
13.3	---	---	---	--	--	--	----	----

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Separation Berm Sample 6U
N116+50 E93+75 Lift 9

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-19-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

REPORT OF FLEXIBLE WALL PERMEABILITY TEST

ASTM DRAFT METHOD

SAMPLE PREPARATION

SAMPLE HEIGHT (L), in: 2.65	MEMBRANE TYPE: Latex, 0.025"
SAMPLE DIAMETER (D), cm: 7.24	PERMEANT FLUID: Distilled, Deaired water
SAMPLE AREA (A), sq. cm: 41.16	CONSOLIDATION PRESSURE, psi: 7
	B PARAMETER: 0.96
	HYDRAULIC GRADIENT (H), psi: 10

TEST DATA

CLOCK TIME 6-22, 6-23	TIME (T) (min)	BURETTE CHANGE lower	upper	FLOW (Q) (ml)	PERMEABILITY (cm/s) = $Q/T[0.0006L/A \cdot H]$
6:50	3830	7.3	7.3	7.3	$7.4 \times 10E-9$
11:35	285	0.5	0.5	0.5	$6.8 \times 10E-9$
4:00	265	0.5	0.5	0.5	$7.3 \times 10E-9$
6:10	850	1.5	1.5	1.5	$6.8 \times 10E-9$
9:30	200	0.3	0.4	0.35	$6.8 \times 10E-9$

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 7 \times 10E-9$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
15.6	115.8	88.6	35.9	26	13	13	121.9	12.5

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Borrow Pit N119+00 Lift 11
Sample 10R

Project No.: 1M-920436
Project: BFI-Zion Facility

Client: BFI Waste Systems

Date: 6-23-1992

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed By: Don Mich

Checked By:
Daniel B. Anderson, P.E.

Appendix E-3E

Construction Documentation, October 1992

▲ Construction Documentation

**Winthrop Harbor
Clay Division Berm
Stations 10800N to 12500N
Constructed September 15-
October 2, 1992**

Prepared for:



**Browning-Ferris Industries
of Illinois, Inc.**

October 1992

CONSTRUCTION DOCUMENTATION

WINTHROP HARBOR
CLAY DIVISION BERM

STATIONS 10800 TO 12500
CONSTRUCTED SEPTEMBER 15 - OCTOBER 2, 1992

PREPARED FOR
BROWNING-FERRIS INDUSTRIES OF ILLINOIS, INC.

October 1992

SEC Donohue Inc.
4738 North 40th Street
Sheboygan, WI 53083

SEC Donohue Project No. 70163

1.0 INTRODUCTION

This report documents construction, testing, and inspection for the clay division berm at Winthrop Harbor Landfill, Zion, Illinois. The project involved construction of an approximately 1,700 feet long clay division berm on the top of the existing clay berm. The approximate limits of the clay berm and project stationing are shown on the "Existing Site Conditions" drawing, provided in Appendix A.

SEC Donohue Inc. was present during construction of the clay division berm to provide construction quality assurance services including: field observations and testing, collection of soil samples for laboratory testing, and daily documentation of construction activities. Construction quality assurance services are summarized in more detail in the following discussions.

This report constitutes certification of substantial compliance with Illinois Environmental Protection Agency (IEPA) Supplemental Permit No. 1985-226-SP, provided in Appendix B.

Personnel involved in project development and construction are as follows:

- o Browning-Ferris Industries of Illinois, Inc. - Owner
 - Don Sampson - Landfill Manager
 - John Dixon - Vice President of Operations
- o SEC Donohue Inc. - Construction Quality Assurance
 - Thomas Windau, P.E. - Certifying Engineer, Project Manager
 - Daren Buchanan - Inspector
 - Steve Pruitt - Inspector
- o Ryan, Inc. - Earthwork Contractor
 - Don Kuzik - Supervisor
- o Giles Engineering Associates, Inc. - Soil Testing Laboratory
 - Don Mich - Laboratory Supervisor

2.0 CONSTRUCTION ACTIVITIES

Construction for the clay division berm began on September 15, 1992. Ryan, Inc., performed all related earthwork activities. The location of the clay division berm was determined and set by BFI and Ryan, Inc. Fill materials utilized for construction generally consisted of a mixture of gray silty clays obtained from an on-site borrow area. Placement of the clay was performed by 20-cubic yard scrapers. After placement, each lift of clay was disced and compacted by a self-propelled sheepsfoot roller. Lift thickness was approximately 6 inches compacted. Clay lifts were tested for compaction in accordance with project specifications. Clay placement operations were complete on October 2, 1992.

Total volume of clay placed was approximately 12,827 in-place cubic yards. Clay volume calculations are provided in Appendix C. Project station cross sections are provided in Appendix D. Photographs showing clay division berm construction activities are provided in Appendix E.

3.0 INSPECTION ACTIVITIES

SEC Donohue Inc. provided continuous inspection and documentation services during construction of the clay division berm between the period of September 9 through October 2, 1992. During this period, the SEC Donohue inspector visually observed construction activities, performed in-field density tests on compacted clay, documented location of the berm as determined by BFI and Ryan, Inc., and collected soil samples for laboratory testing. Observations were recorded on daily field reports.

A total of 47 in-field density tests were performed by the SEC Donohue inspector to monitor in-place clay moisture and density values. Clay density and moisture content were measured with a Troxler Nuclear Density/Moisture Gauge in accordance with ASTM D2922.

Material used to construct the berm was obtained from borrow area Cell 2. Laboratory data indicated a maximum dry density of 119.6 pcf for material from Cell 2. The value of 119.6 pcf was used throughout construction for determining in-place moisture content and percent compaction. Density test results indicated compaction meeting or exceeding project specifications of 95 percent of Standard Proctor. Field density test results are provided in Appendix F.

Clay division berm grade documentation was performed to aid in estimating clay quantities. All documentation was referenced from site grid stationing. Stationing is shown on the drawing, "Existing Site Conditions", provided in Appendix A.

4.0 SOIL TESTING

Laboratory tests were performed on clay soil samples to verify index properties (i.e., Atterberg Limits and P200 content) and permeability in accordance with project specifications and IEPA Supplemental Permit No. 1985-226-SP. Laboratory soil test results are provided in Appendix G.

For this project, a total of 3 tests were performed on soil placed in the berm for Atterberg Limits and P200 content determinations. Test results indicated that Plasticity Indices (PI) and P200 contents ranged from 11 to 13 and 85.5 to 88.2 percent, respectively. Based on laboratory index tests, the berm soil is classified "Gray Silty Clay" (CL) as determined by the Unified Soil Classification System.

Three relatively undisturbed clay samples were recovered by Shelby tubes for laboratory hydraulic conductivity testing. Hydraulic conductivity test results indicate permeabilities of the clay samples of 6×10^{-9} cm/sec, 7×10^{-9} , and 8×10^{-9} cm/sec, which are less than the required maximum of 1×10^{-7} cm/sec.

5.0 CONCLUSION

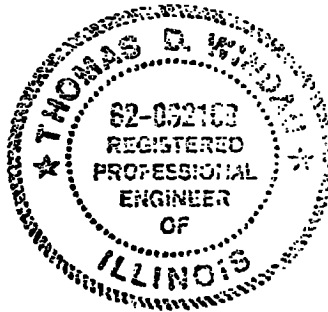
During construction of this portion of the clay division berm at the Winthrop Harbor facility, SEC Donohue performed quality assurance services. These services included field observations and clay density/moisture testing, and collection of soil samples for laboratory testing. In summary, field and laboratory test results showed substantial compliance to project specifications, indicating construction of the clay division berm was performed in a satisfactory manner.

6.0 CERTIFICATION

Based on our professional judgement on information obtained through on-site observations and field and laboratory soil test results, the clay division berm for the Winthrop Harbor facility was constructed in substantial accordance with project specifications.

Thomas Windau

Thomas Windau, P.E.
Certifying Engineer



RP/BFIWINTH/AB8

APPENDIX A
EXISTING SITE CONDITIONS

APPENDIX B

**ILLINOIS ENVIRONMENTAL PROTECTION
AGENCY SUPPLEMENTAL PERMIT**



217/782-6762

Refer to: 0978020001 - Lake County
Winthrop Harbor/BFI #1
Supplemental Permit No. 1985-226-SP
Log Nos. 1985-090 and 1985-226

March 20, 1986

Browning-Ferris Industries
1827 Walden Office Square, Suite 107
Schaumburg, Illinois 60195

Gentlemen:

Supplemental permit is hereby granted to Browning-Ferris Industries, as owner and operator, to construct a berm along the eastern boundary of the above-referenced solid waste management site and to deposit non-hazardous waste in the area between this berm and the existing contours of the site. Final plans, specifications, application and supporting documents as submitted and approved shall constitute part of this permit and are identified in the records of the Illinois Environmental Protection Agency, Division of Land Pollution Control by the permit number and log number designated in the heading above.

This supplemental permit is issued subject to the standard conditions attached hereto and incorporated herein by reference, and further subject to the following special conditions:

1. In case of conflict between the application and plans submitted and these special conditions, the special conditions of this permit shall govern development and operation of the subject site.
2. Only nonhazardous wastes may be disposed in the area which is the subject of this permit.
3. After receipt at the site, but prior to disposal, every container of waste to be disposed in this area shall be sampled and analyzed by the paint filter test described in 35 Ill. Adm. Code 729.320. No wastes that yield fluid may be deposited in this area.
4. The diversion berm shall be constructed in accordance with the specifications identified in the document entitled "Slope Stability Analysis, Winthrop Harbor Landfill Nos. 1 & 2, Waukegan, Illinois," by Donohue and Associates, dated December, 1985. To ensure these specifications are met, the Construction Documentation Program in Appendix B of this document shall be adhered to, with the following exceptions:



Page 2

- a. Lifts of soil no more than nine inches thick (+) shall be used in constructing the berms;
 - b. Each lift shall be disced prior to compacting;
 - c. The soil placed in each lift shall be approximately three to five percent above the optimum moisture content to ensure the desired permeability is obtained upon compaction. If the moisture content of the soil excavated for use is below this level, water shall be added to obtain the desired moisture content.
 - d. Each lift shall be compacted to 95% of the Standard Proctor density (ASTM: D698);
 - e. The field density of each compacted lift shall be determined on 200 feet intervals. ASTM methods shall be used in making this determination;
 - f. One lab moisture density test shall be conducted for every 5000 cubic yards of soil used in constructing the berm, or when the borrow soil changes. The P200, clay content (less than 0.002 mm), grain size distribution curve, Atterburg limits and USCS soil classification shall be determined at the same frequency.
-
- g. Provisions shall be made to key the bottom of each successive ten foot berm into the top of the lower berm. This may include scarifying and wetting the top of the lower berm prior to placing the initial lift of the upper berm. Other procedures may also be used to key the upper berm into the lower berm.
5. A registered professional engineer shall certify that the soil used in the construction of the berm:
 - a. Is compacted to a minimum density which is 95 percent of the Standard Proctor Density (ASTM:D698);
 - b. Has an in-place permeability no greater than 1×10^{-7} cm/sec.

This certification shall be submitted to the Agency, as described in Special Condition No. 6 below. A report from a registered professional engineer documenting that the berm was constructed in accordance with the procedures set forth in Special Condition No. 4 above shall also be submitted to the Agency. These documents shall be developed each time a portion of the berm is constructed, and shall be submitted to the Agency before waste is placed against the newly constructed berm.



Page 3

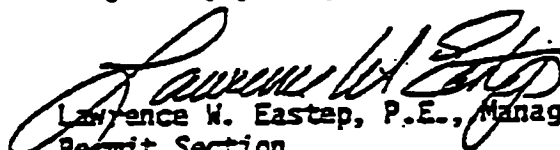
6. Unless otherwise indicated, all certifications, logs, reports and plan sheets which are required to be submitted to the Agency by the permittee shall be mailed to the following address:

Illinois Environmental Protection Agency
Compliance Monitoring Section
Division of Land Pollution Control — #24
2200 Churchill Road
Springfield, Illinois 62706

7. Prior to placing waste against a portion of the newly constructed berm, the berm shall be inspected and approved by the Field Operations Section of this Division.

Except as modified in the above documents and in any supplemental permits issued by the Agency, this site shall be developed and operated in accordance with the terms and conditions of Permit No. 1975-53-OP, dated November 11, 1975.

Very truly yours,


Lawrence W. Eastep, P.E., Manager
Permit Section
Division of Land Pollution Control

LWE:JKM:rd0601F/1-3

Attachment

cc: Division File
Northern Region
Donohue and Associates
Fred Prillaman

APPENDIX C
VOLUME CALCULATIONS

VOLUME COMPUTATIONS

R 001166

Donohue
Engineers & Architects

CLIENT BFI - WINTHROP HARBOR PAGE NO. 1

PROJECT CLAY DIVISION DERM PROJECT NO. 70163

DATE 10/14/92 BY 70W CHECKED BY _____

CUT OR ☒ FILL MATERIAL _____
CIRCLE ONE

STATION	SECTION LIMITS	DISTANCE	END AREA	TOTAL OF END AREAS	AVERAGE END AREA	VOLUME
108	00					
		100		107.7	53.85	5385
109	00		107.7			
		100		261.4	130.7	13070
110	00		153.7			
		100		344.7	172.35	17235
111	00		191.0			
		100		451.8	225.9	22590
112	00		260.8			
		100		586.0	293.0	29300
113	00		325.2			
		100		749.3	374.65	37465
114	00		424.1			
		100		794.1	397.05	39705
115	00		370.0			
		100		680.2	340.1	34010
116	00		310.2			

COMMENTS:

VOLUME COMPUTATIONS

Donohue
Engineers & Architects

CLIENT BFI - WINTHROP HARBOR PAGE NO. 2

PROJECT CLAY DIVISION BERM PROJECT NO. 70163

DATE 10/14/92 BY 70W CHECKED BY _____

CUT OR (FILL) MATERIAL _____
CIRCLE ONE

STATION	SECTION LIMITS	DISTANCE	END AREA	TOTAL OF END AREAS	AVERAGE END AREA	VOLUME
116	00		310.2			
		100		543.5	271.75	27175
117	00		233.3			
		100		409.0	204.50	20450
118	00		175.7			
		100		331.0	165.50	16550
119	00		155.3			
		100		251.2	125.60	12560
120	00		95.9			
		100		190.8	95.4	9540
121	00		94.9			
		100		194.4	97.2	9720
122	00		99.5			
		100		309.5	154.75	15475
123	00		210.0			
		100		465.9	232.95	23295
124	00		255.9			
		100		255.9	127.95	12795
125	00		0			

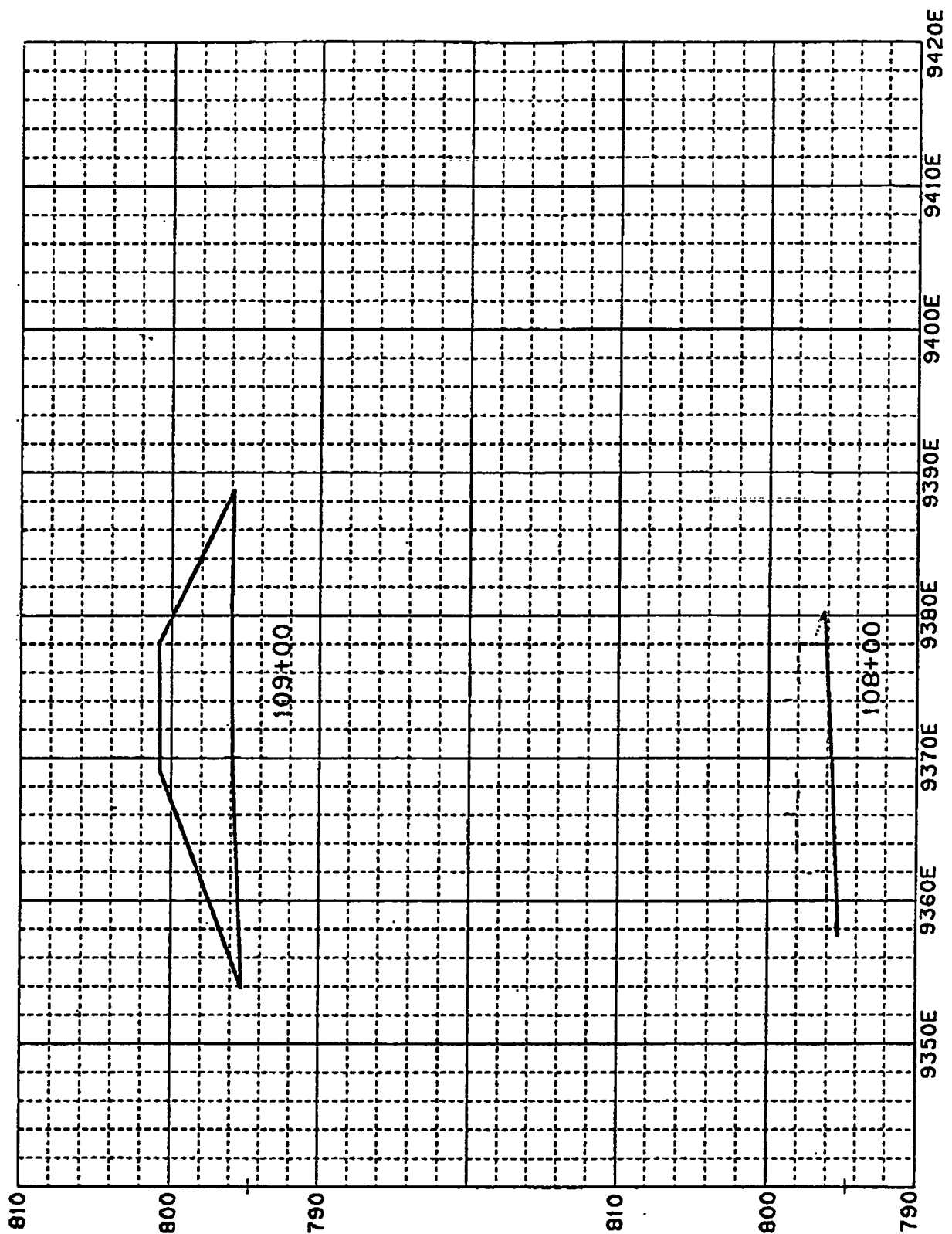
COMMENTS:

Σ 346,320 ft³

12,827 yd³

APPENDIX D

CLAY DIVISION BERM CROSS-SECTIONS

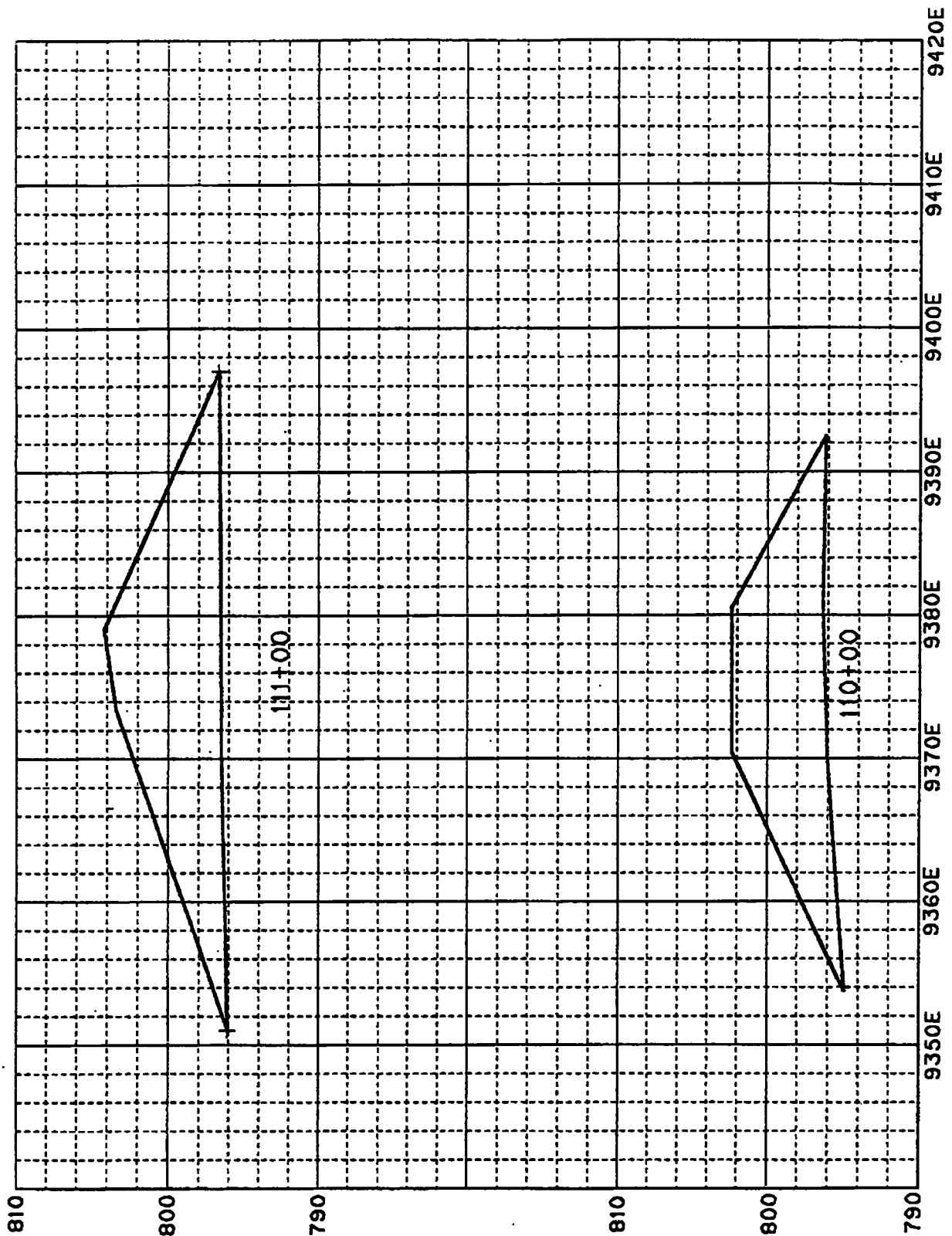


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Environment & Infrastructure

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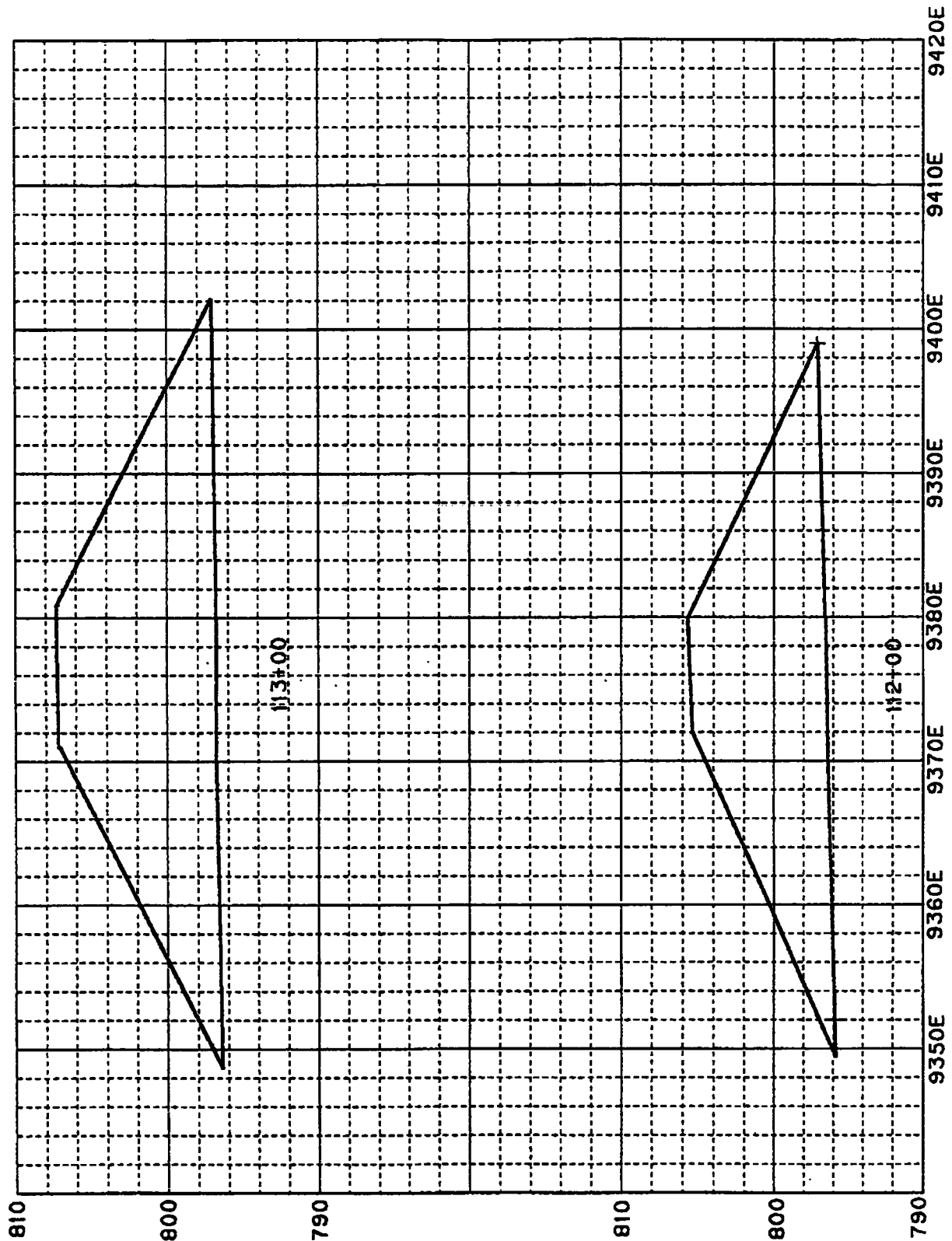
CROSS SECTION
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS



OCTOBER 1992

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CROSS SECTION
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

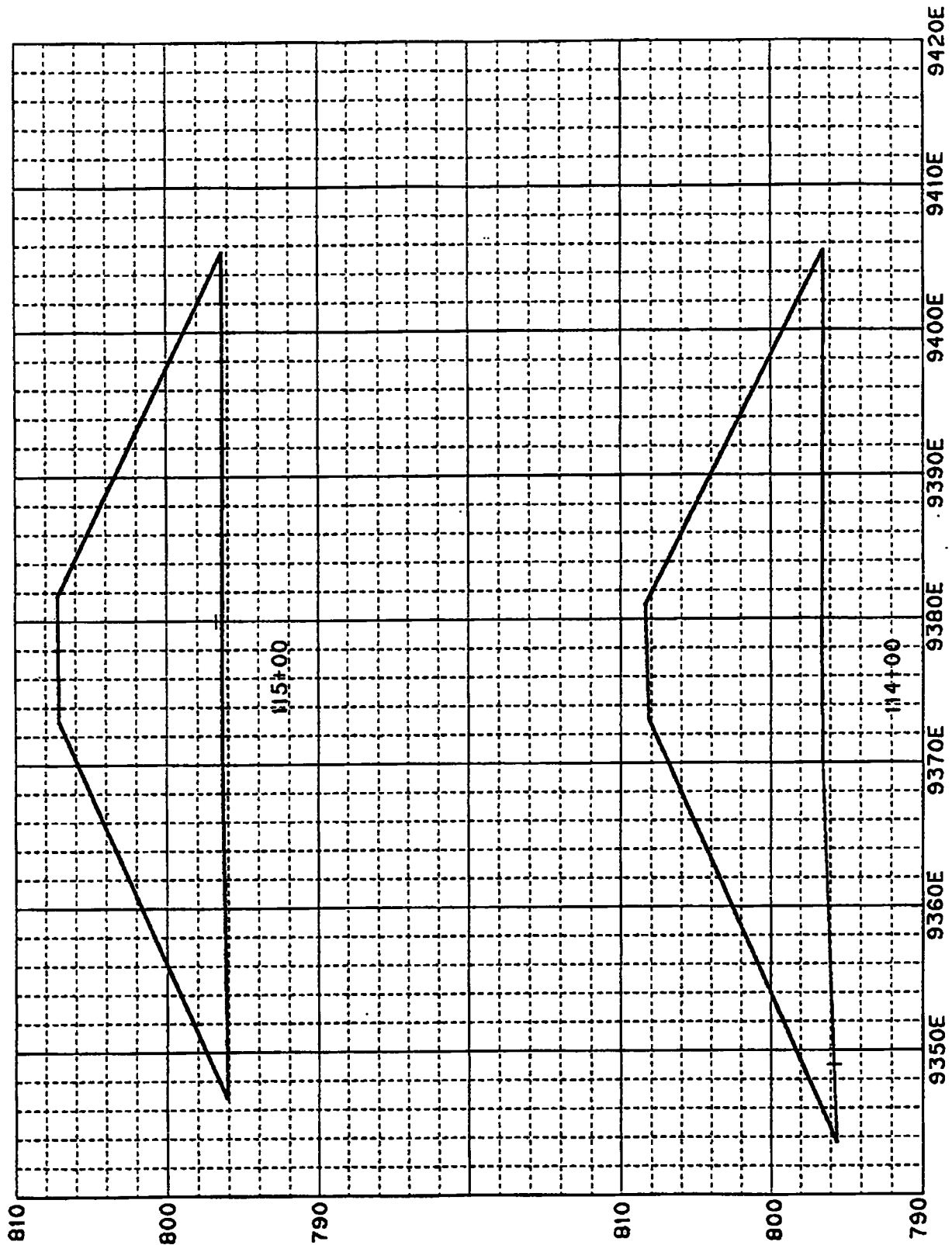


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CROSS SECTION
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

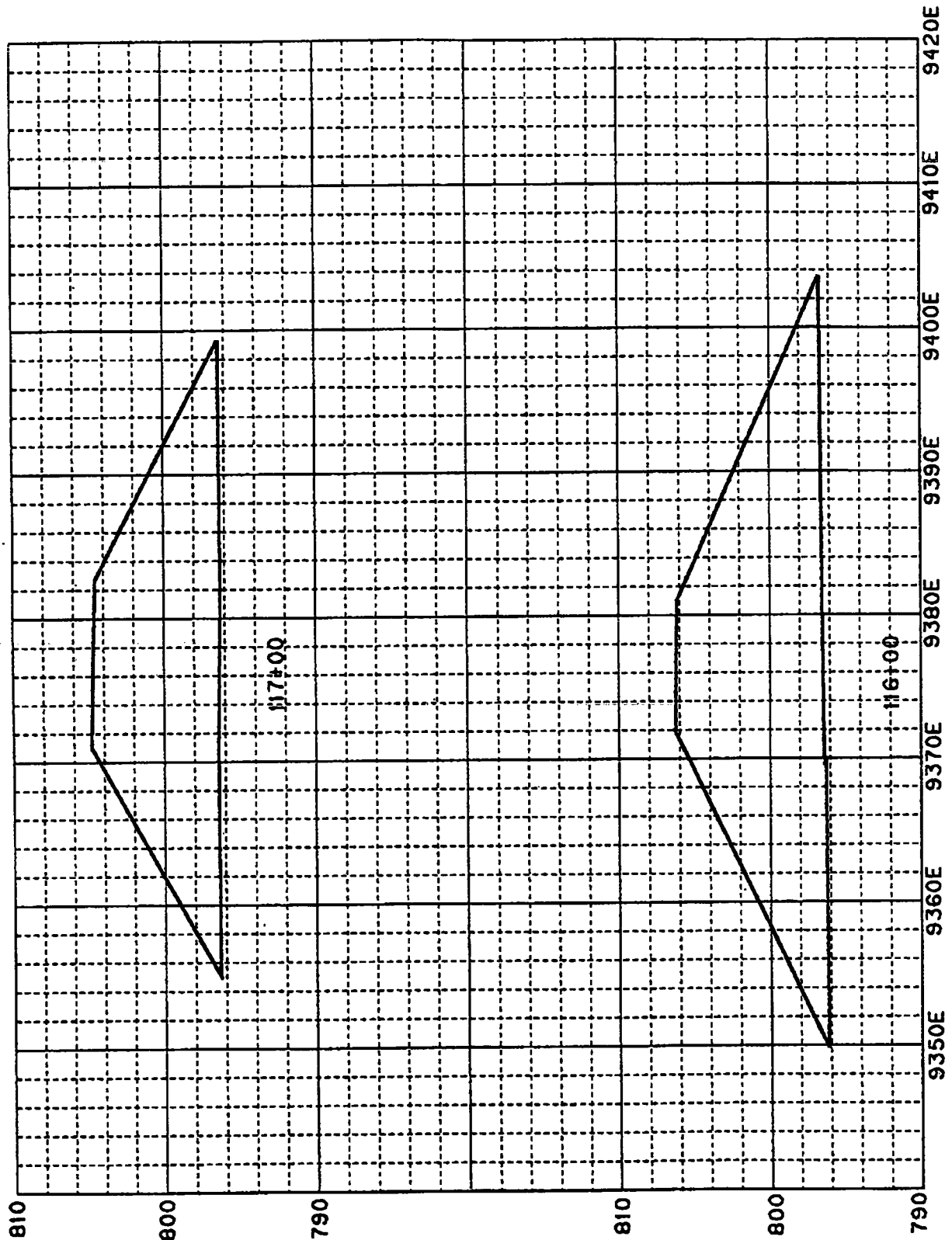


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CROSS SECTION
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

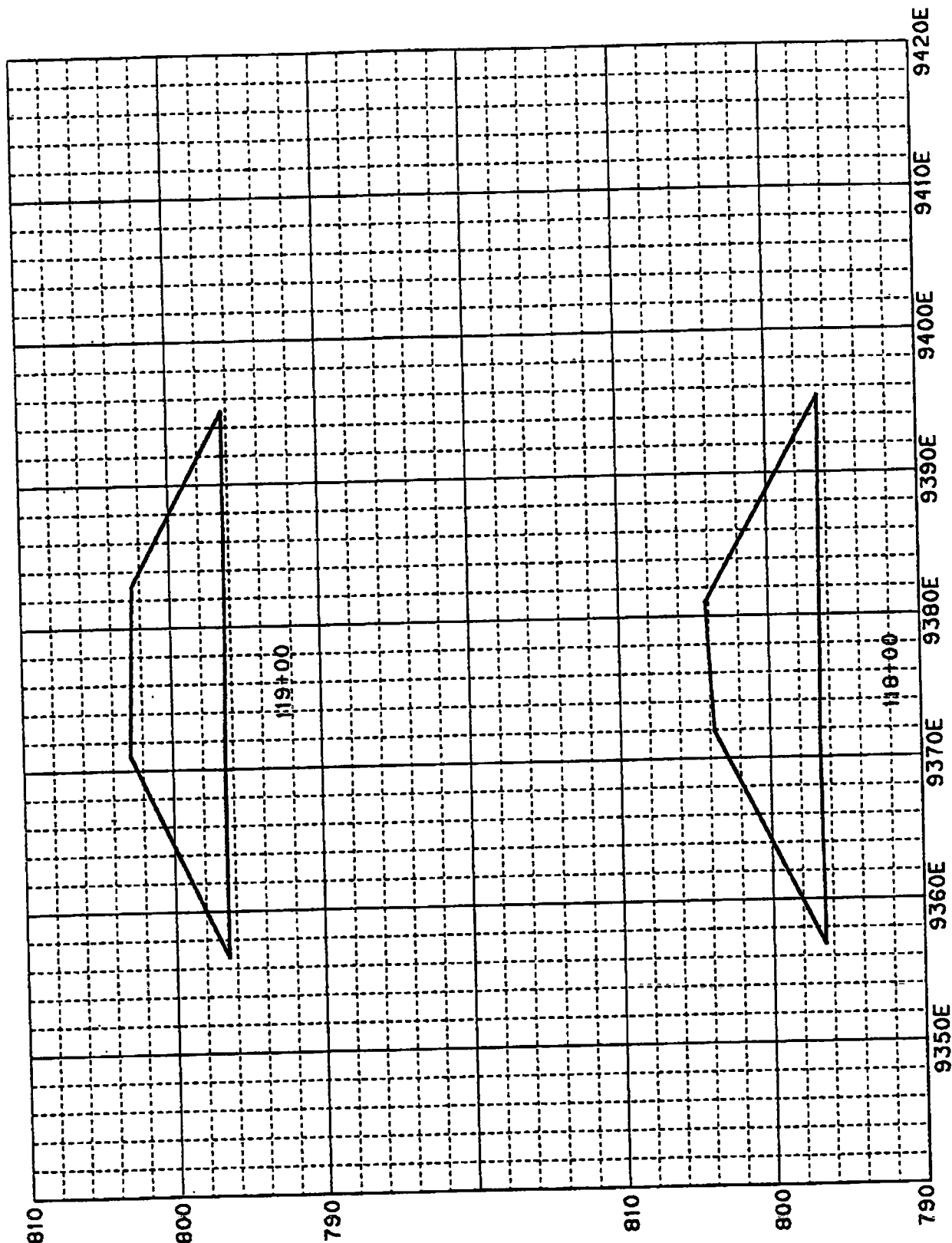


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CROSS SECTION
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

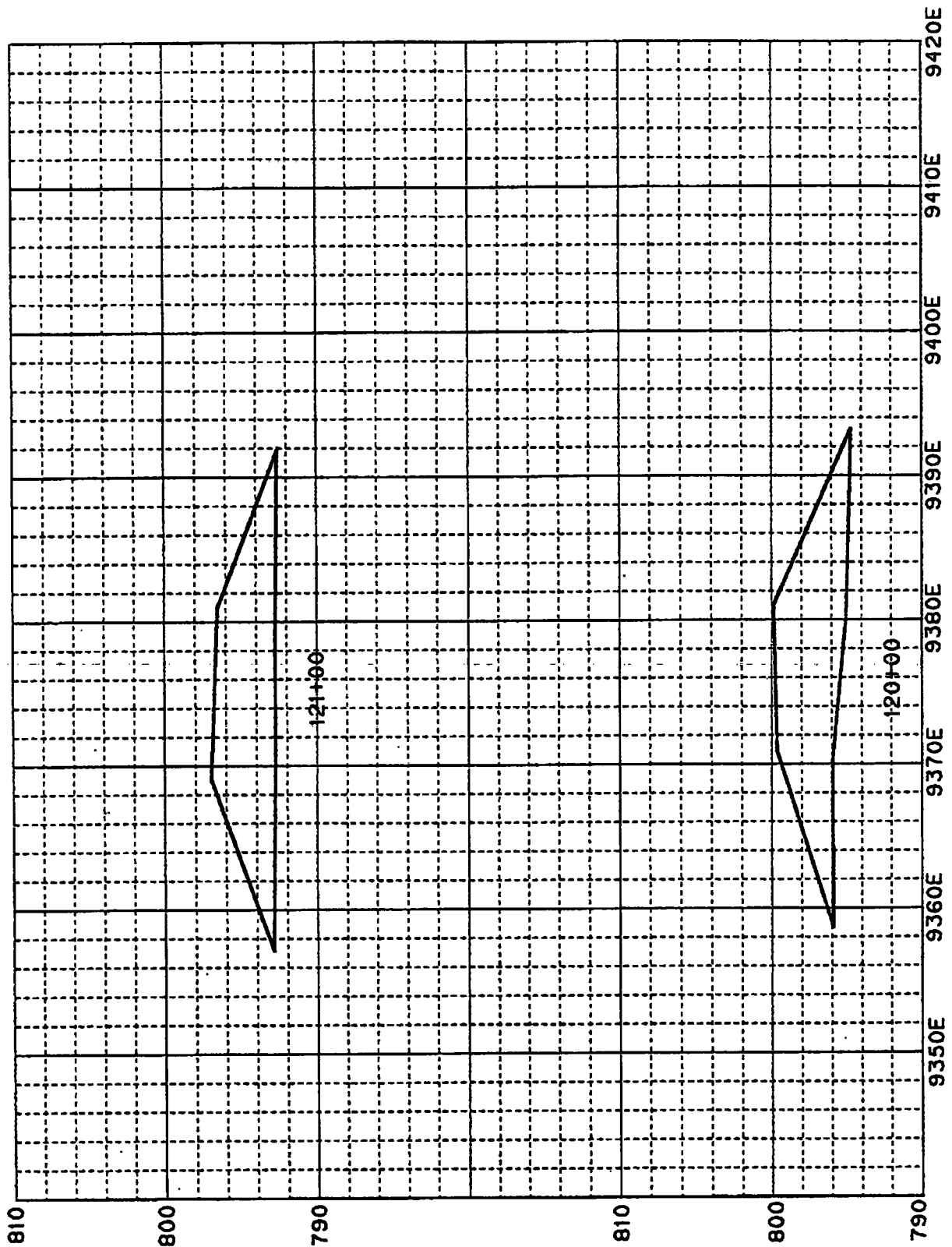


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CROSS SECTION
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

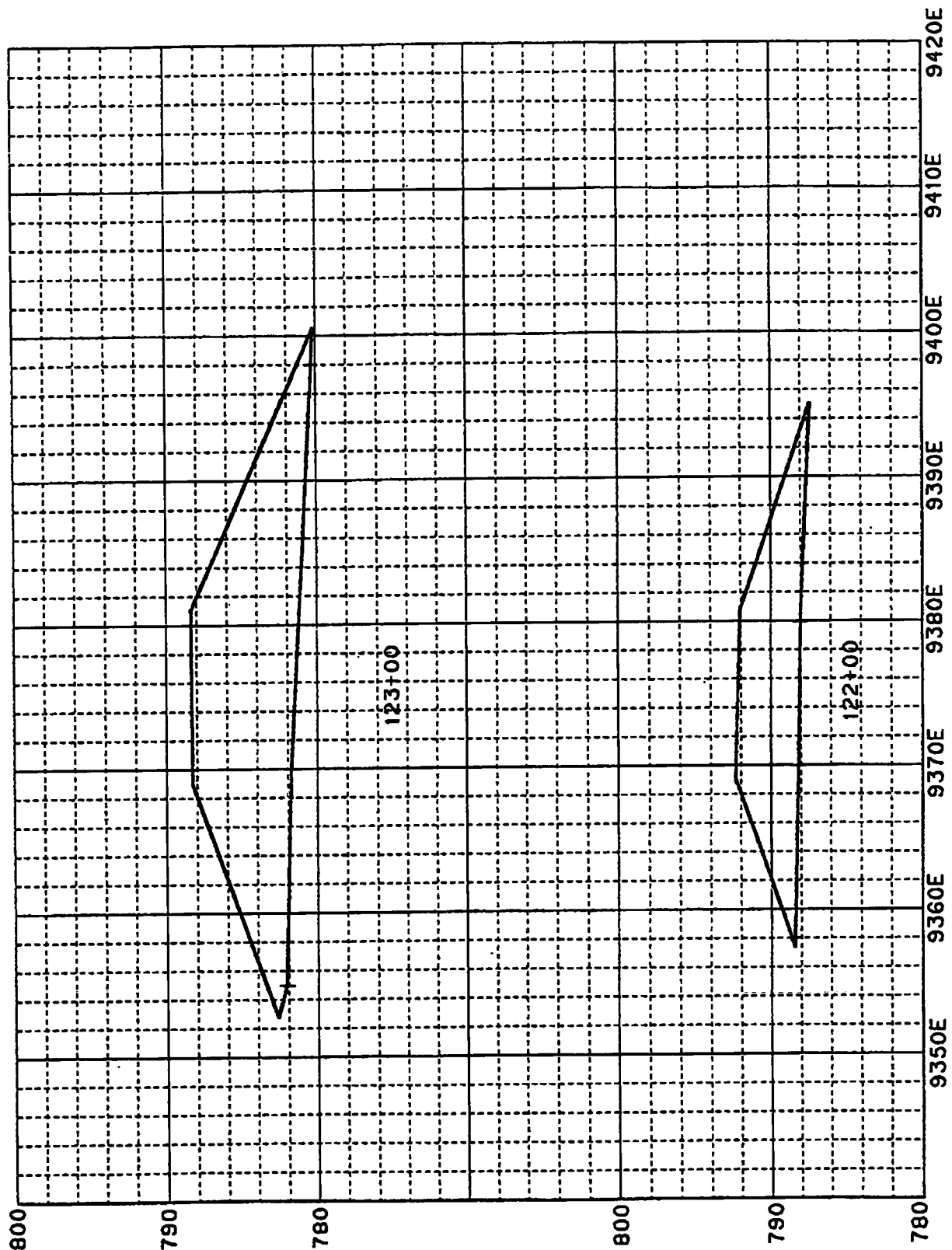


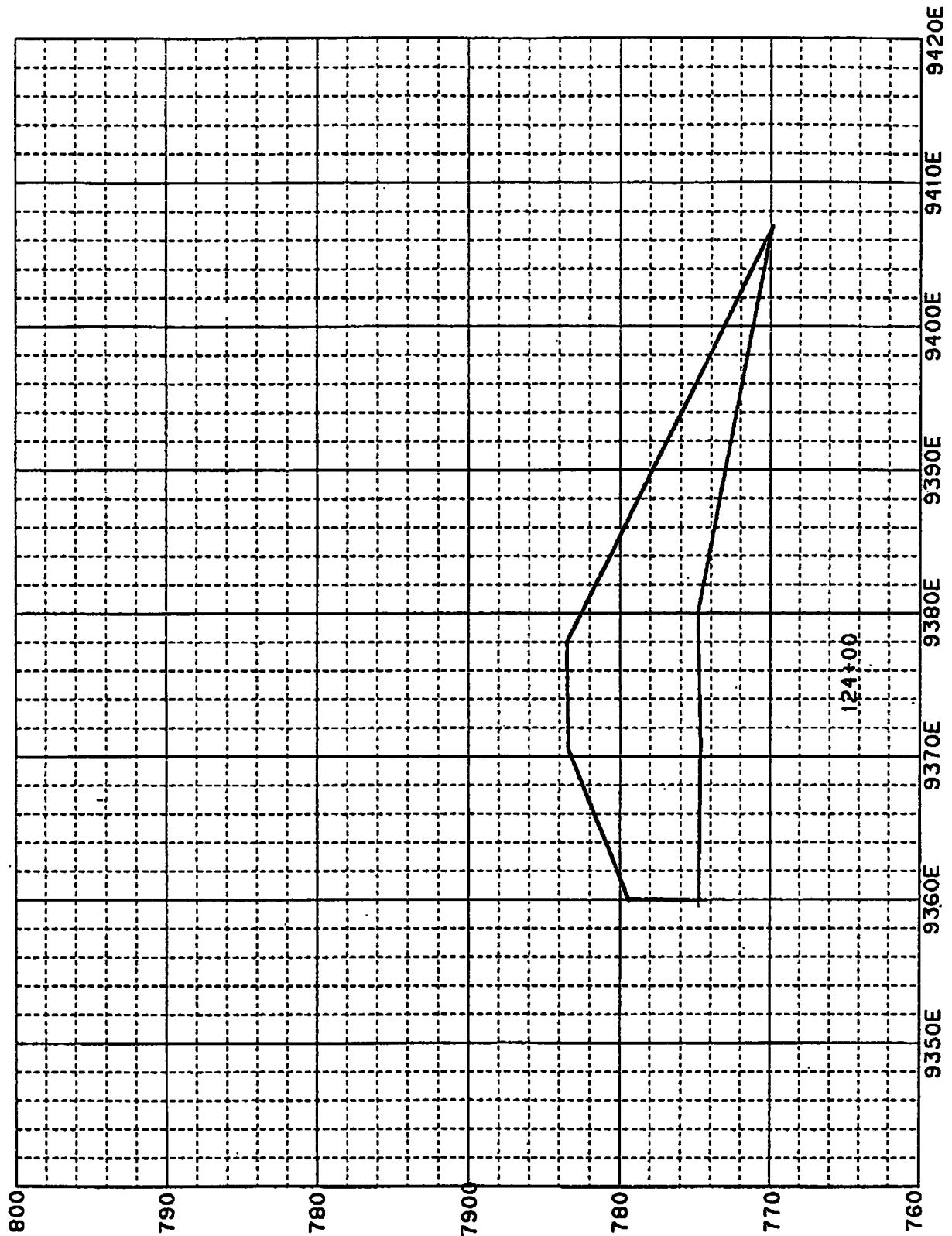
SEC DONOHUE
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OCTOBER 1992

70163

CROSS SECTION
BROWNING-FERRIS INDUSTRIES
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS





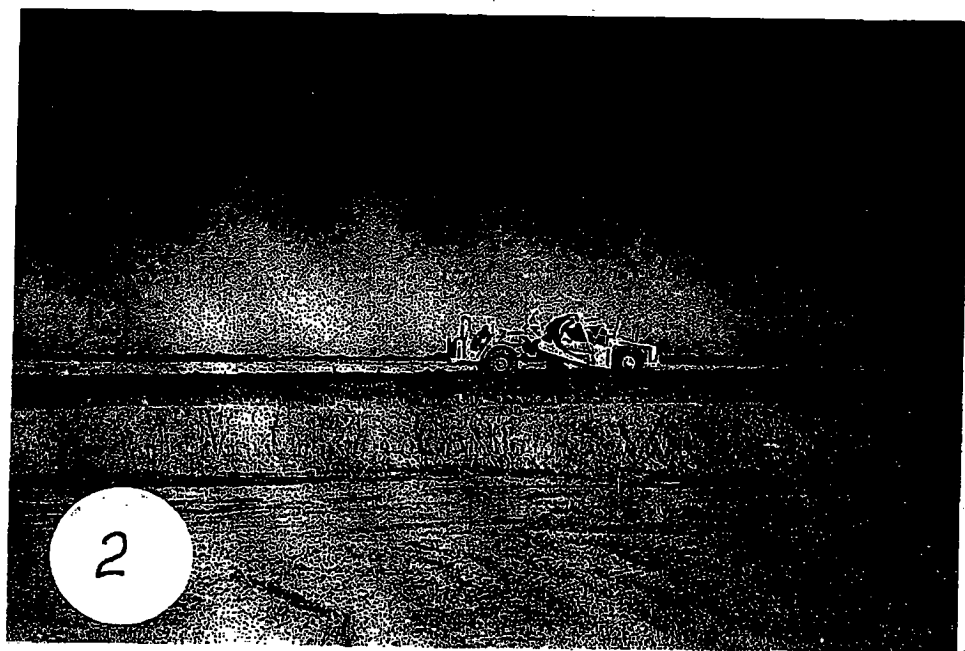
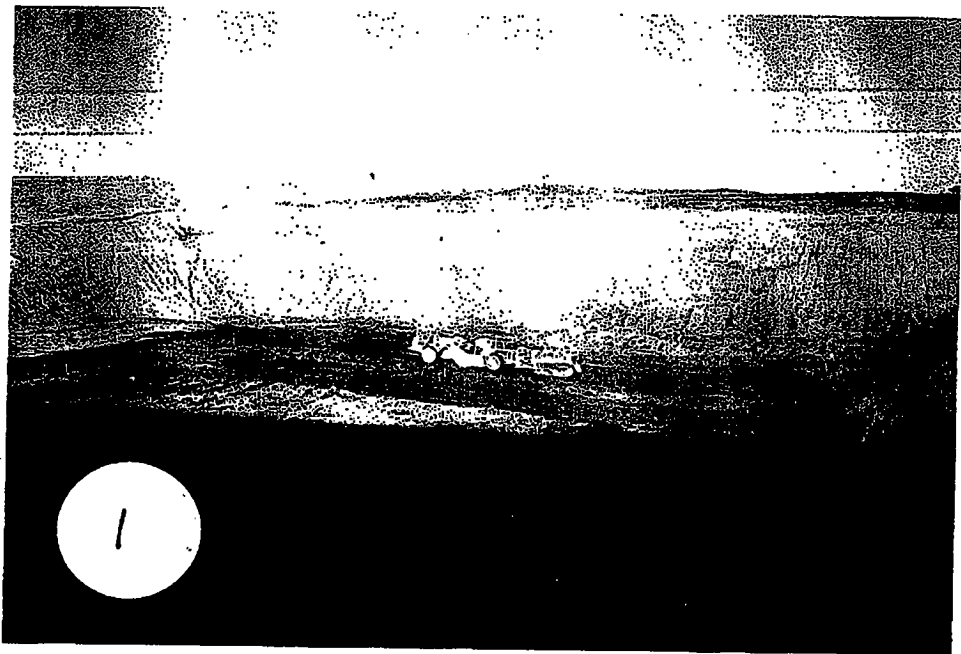
APPENDIX E
PHOTOGRAPHS

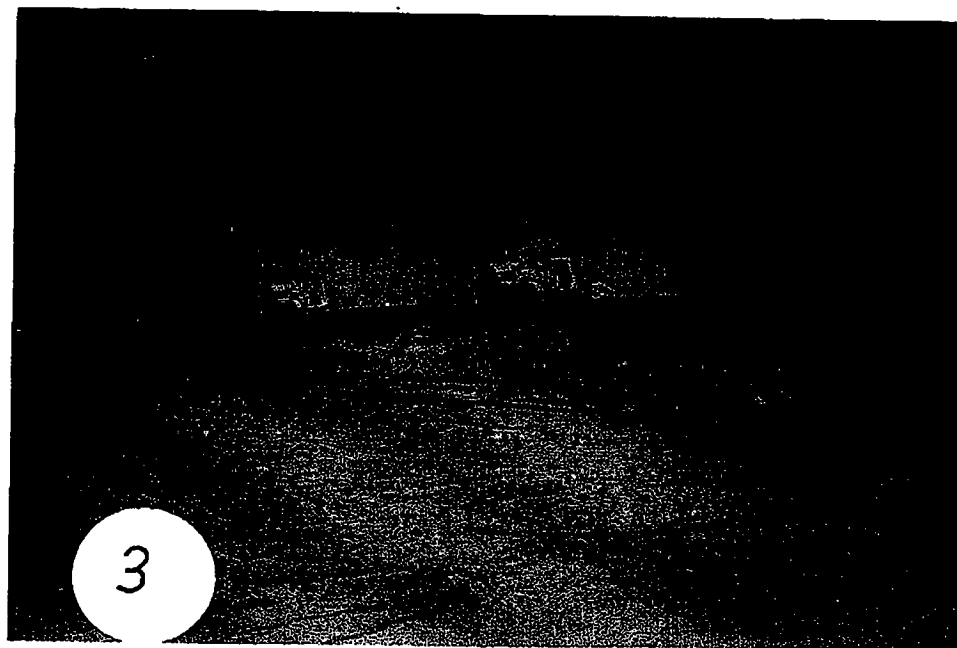
APPENDIX E

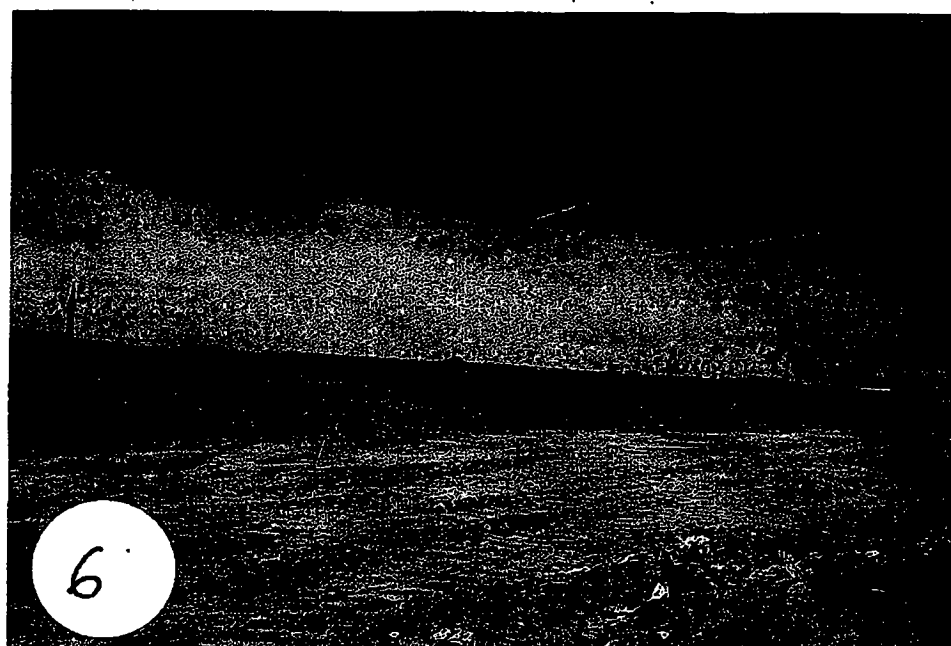
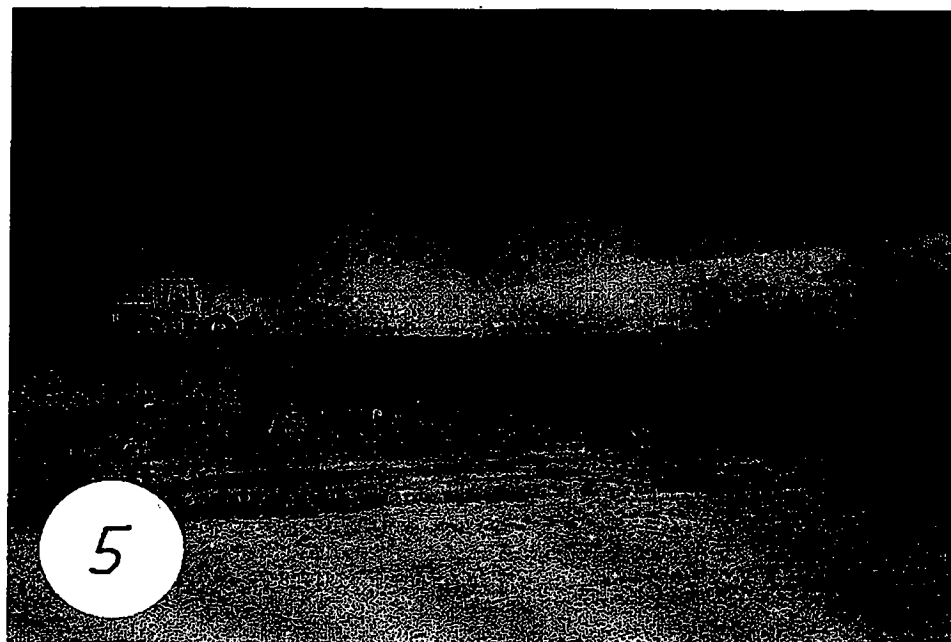
PHOTOGRAPHS

<u>Photograph No.</u>	<u>Description</u>
1	Getting clay material from Cell 2 borrow pit.
2	Scraper delivering and placing clay material to berm.
3	Scrapers delivering and placing clay material to berm.
4	Sheepsfoot compacting clay material on top of berm.
5	Compaction work on top of berm.
6	View of berm under construction.
7	View of completed berm.
8	View of completed berm.

RP/BFIWINTH/AC1









APPENDIX F
FIELD DENSITY TEST RESULTS

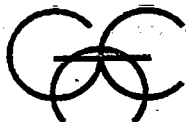
FIELD DENSITY/MOISTURE TEST DATA
FOR
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

DATE	TEST NUMBER	RETEST NUMBER	COORDINATES NORTH	EAST	LIFT	PROBE DEPTH (in)	WET DENS (pcf)	DRY DENS (pcf)	MOIST (pcf)	% MOIST	PROC (pcf)	% COMP
09/23/92	25.01		115+00	93+70	1	8	138.2	120.0	18.2	15.2%	119.6	100.3%
09/23/92	25.02		109+50	93+80	1	8	138.7	120.7	18.0	14.9%	119.6	100.9%
09/24/92	26.01		110+00	93+75	1	8	138.2	120.6	17.6	14.6%	119.6	100.8%
09/24/92	26.02	27.01	108+50	93+80	2	8	138.3	122.0	16.3	13.4%	119.6	102.0%
09/24/92	26.03	27.03	113+00	93+70	1	8	146.0	130.4	15.6	12.0%	119.6	109.0%
09/24/92	26.04		106+50	93+75	1	8	135.4	117.9	17.5	14.8%	119.6	98.6%
09/25/92	27.01	26.02	109+00	93+75	1	8	138.0	120.7	17.3	14.3%	119.6	100.9%
09/25/92	27.02		110+75	93+00	2	8	136.0	117.5	18.5	15.7%	119.6	98.2%
09/25/92	27.03	26.03	113+00	93+75	1	8	138.5	121.4	17.1	14.1%	119.6	101.5%
09/25/92	27.04		116+00	93+80	1	8	135.6	118.0	17.6	14.9%	119.6	98.7%
09/25/92	27.05		117+50	93+70	1	8	135.4	116.6	18.8	16.1%	119.6	97.5%
09/25/92	27.06		116+75	93+75	2	8	134.7	115.5	19.2	16.6%	119.6	96.6%
09/25/92	27.07		118+30	93+72	2	8	135.4	117.9	17.5	14.8%	119.6	98.6%
09/28/92	28.01		109+50	93+70	3	8	136.9	118.5	18.4	15.5%	119.6	99.1%
09/28/92	28.02		110+00	93+73	3	8	135.4	117.8	17.6	14.9%	119.6	98.5%
09/28/92	28.03		113+25	93+78	3	8	136.9	119.5	17.4	14.6%	119.6	99.9%
09/28/92	28.04		115+70	93+70	3	8	135.4	117.9	17.5	14.8%	119.6	98.6%
09/28/92	28.05		117+20	93+78	2	8	136.3	117.9	18.4	15.6%	119.6	98.6%
09/28/92	28.06		123+50	93+65	1	8	135.8	117.5	18.3	15.6%	119.6	98.2%
09/28/92	28.07		119+00	93+78	2	8	135.6	118.0	17.6	14.9%	119.6	98.7%
09/29/92	29.01		117+00	93+75	3	8	134.7	116.6	18.1	15.5%	119.6	97.5%
09/29/92	29.02		114+10	93+73	4	8	137.6	119.5	18.1	15.1%	119.6	99.9%
09/29/92	29.03		112+00	93+78	4	8	135.6	116.3	19.3	16.6%	119.6	97.2%
09/29/92	29.04		111+25	93+75	4	8	134.1	114.9	19.2	16.7%	119.6	96.1%
09/29/92	29.05		113+50	93+70	4	8	134.2	115.7	18.5	16.0%	119.6	96.7%
09/29/92	29.06		115+25	93+73	4	8	135.5	116.1	19.4	16.7%	119.6	97.1%
09/29/92	29.07		112+20	93+78	5	8	133.9	115.8	18.1	15.6%	119.6	96.8%
09/29/92	29.08		113+40	93+73	6	8	135.3	116.8	18.5	15.8%	119.6	97.7%

FIELD DENSITY/MOISTURE TEST DATA
FOR
WINTHROP HARBOR - CLAY DIVISION BERM
ZION, ILLINOIS

DATE	TEST NUMBER	RETEST NUMBER	COORDINATES NORTH	EAST	LIFT	PROBE DEPTH (in)	WET DENS (pcf)	DRY DENS (pcf)	MOIST (pcf)	% MOIST	PROC (pcf)	% COMP
09/30/92	30.01		116+00	93+72	4	8	137.4	119.1	18.3	15.4%	119.6	99.6%
09/30/92	30.02		115+05	93+78	5	8	136.4	118.1	18.3	15.5%	119.6	98.7%
09/30/92	30.03		114+00	93+75	5	8	136.0	117.7	18.3	15.5%	119.6	98.4%
09/30/92	30.04		113+75	93+78	7	8	136.9	118.6	18.3	15.4%	119.6	99.2%
09/30/92	30.05		114+25	93+72	6	8	138.2	120.6	17.6	14.6%	119.6	100.8%
09/30/92	30.06		115+50	93+75	6	8	137.8	119.3	18.5	15.5%	119.6	99.7%
09/30/92	30.07		118+00	93+70	4	8	132.6	113.9	18.7	16.4%	119.6	95.2%
09/30/92	30.08		121+00	93+78	2	8	134.0	115.3	18.7	16.2%	119.6	96.4%
09/30/92	30.09		119+50	93+75	3	8	135.9	117.4	18.5	15.8%	119.6	98.2%
09/30/92	30.10		120+00	93+72	3	8	135.6	116.3	19.3	16.6%	119.6	97.2%
09/30/92	30.11		114+00	93+75	7	8	136.9	118.6	18.3	15.4%	119.6	99.2%
10/01/92	30.01		122+50	93+72	2	8	134.2	116.6	17.6	15.1%	119.6	97.5%
10/01/92	30.02		124+00	93+78	3	8	136.4	117.9	18.5	15.7%	119.6	98.6%
10/01/92	30.03		121+25	93+75	2	8	137.0	118.1	18.9	16.0%	119.6	98.7%
10/01/92	30.04		122+25	93+78	3	8	135.9	117.9	18.0	15.3%	119.6	98.6%
10/01/92	30.05		123+00	93+72	3	8	137.7	119.3	18.4	15.4%	119.6	99.7%
10/01/92	30.06		123+50	93+78	4	8	135.4	117.8	17.6	14.9%	119.6	98.5%
10/01/92	30.07		117+25	93+72	5	8	137.1	118.8	18.3	15.4%	119.6	99.3%
10/01/92	30.08		116+25	93+78	6	8	136.4	118.9	17.5	14.7%	119.6	99.4%

APPENDIX G
LABORATORY SOIL TEST RESULTS



MILWAUKEE, WI
LOS ANGELES, CA
WASHINGTON, D.C.

GILES ENGINEERING ASSOCIATES, INC.

GEOTECHNICAL, GEO-ENVIRONMENTAL
AND CONSTRUCTION MATERIALS CONSULTANTS
N8 W22350 JOHNSON ROAD, SUITE A1 / WAUKESHA, WI 53186
414-544-0118, FAX, 414-549-5868

October 14, 1992

SEC Donohue
4738 North 40th Street
Sheboygan, WI 53083

Attention: Mr. Tom Windau

Subject: QA/QC Laboratory Testing Services
BFI-Zion Facility
Separation Berm
GEA Project No. 1M-920623

Dear Mr. Windau:

In accordance with your request, Quality Assurance/Quality Control Laboratory Testing has been performed on landfill samples submitted by your personnel from the above referenced project. The purpose of the landfill testing was to determine pertinent engineering characteristics landfill materials for verification of project specification compliance.

The QA/QC Laboratory Testing has been performed in accordance with applicable ASTM Standards and Wisconsin Administrative Code Section NR 516 Testing Specifications. Laboratory Testing for the materials submitted for this project consisted of performing the following tests.

1. Moisture content (ASTM D2216).
2. Dry density (ASTM D2732).
3. Grain size analysis (ASTM D4318).
4. Atterberg limits (ASTM D4318).
5. Standard proctor (ASTM D698).
6. Falling head permeability (rigid wall).
7. USCS soil classification (ASTM D2487).

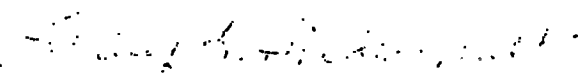
QA/QC Laboratory Testing Services
BFI-Zion Facility
GEA Project No. 1M-920623
Page 2

Results of the tests performed on the samples submitted indicated the clay berm samples tested met or exceeded WDNR specifications for this project. The test results are summarized on the following test data summary report and the individual test reports are appended.

GEA appreciates the opportunity to be of service on this project. If there are any questions in regards to this letter or if GEA can be of further service please do not hesitate to call at any time.

Very truly yours,

GILES ENGINEERING ASSOCIATES, INC.



Shelley Hildebrant, Geologist
Senior Lab Assistant

Don Mich, Geologist
Laboratory Manager

Enclosures: Test Data Summary Reports
Report of Grain Size Analysis
Report of Proctor Test
Report of Permeability Test

Oct92\8/car/BU152
M0623L.RFT

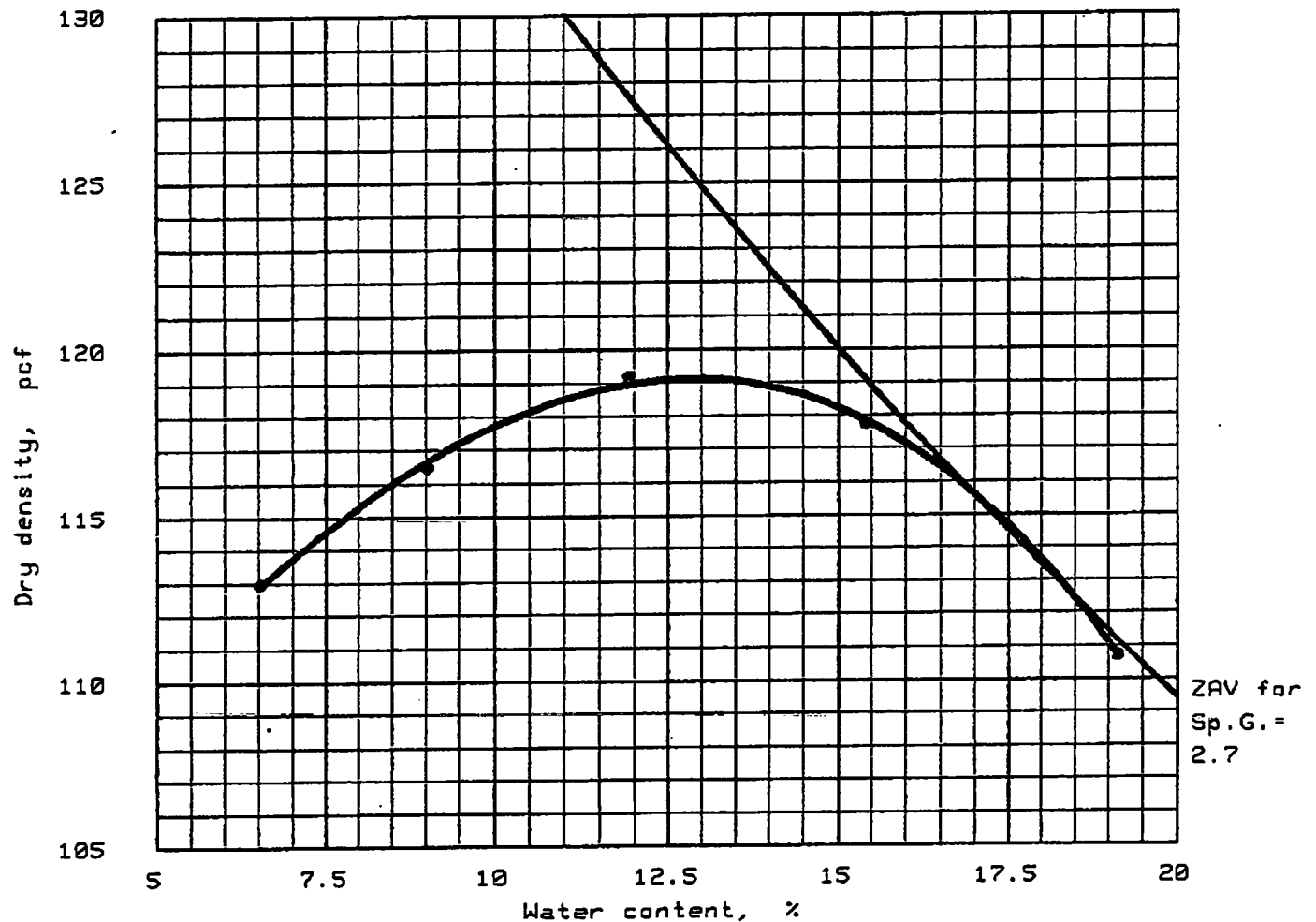
SUMMARY OF QA/QC LABORATORY TEST RESULTS

BFI-Zion Facility
Clay Berm

G.E.A. Project No. 1M-920623

SAMPLE ID NO.	LOCATION	IN SITU		GRAINSIZE		ATTERBERG LIMITS		USCS CLASS.	MOISTURE-DENSITY RELATION.		PERMEABILITY (cm/s)
		MOISTURE CONTENT (%)	DRY UNIT WEIGHT (p.c.f.)	P200 (%)	CLAY (0.005mm) (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)		MAXIMUM DRY DENSITY (p.c.f.)	OPTIMUM MOISTURE (%)	
11R	Borrow Pit	16.2	----	87.4	46.2	26	13	CL	119.1	12.8	-----
1	Cell 2 Floor	14.9	----	84.3	38.6	26	11	CL	119.6	13.6	-----
2	East Borrow Area	14.5	----	72.0	29.0	25	13	CL	118.5	13.3	7 x 10E-8
3	111+50N West Edge	16.6	117.6	88.2	36.3	27	12	CL	119.4	13.7	6 x 10E-9
4	117+00N	15.0	119.8	85.5	39.9	25	12	CL	120.3	13.1	8 x 10E-9
5	121+00N	15.2	115.5	88.1	45.6	25	11	CL	119.8	13.4	7 x 10E-9
MDNR Specifications				50	25	25	10				1 x 10E-7
High		16.6	119.8	88.2	46.2	27	13		120.3	13.7	8 x 10E-8
Low		14.5	115.5	72.0	29.0	25	11		118.5	12.8	6 x 10E-8
Mean		15.6	117.7	80.1	37.6	26	12		119.4	13.3	7 x 10E-8

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 119.1 pcf

Optimum moisture = 12.8 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
11R	CL		16.2 %	2.7	26	13	0.0 %	87.4 %

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay with Sand

Borrow Pit

Project No.: 1M-920623
Project: BFI-Zion Facility
Client: BFI Waste Systems

Date: 6-16-1992

Remarks:

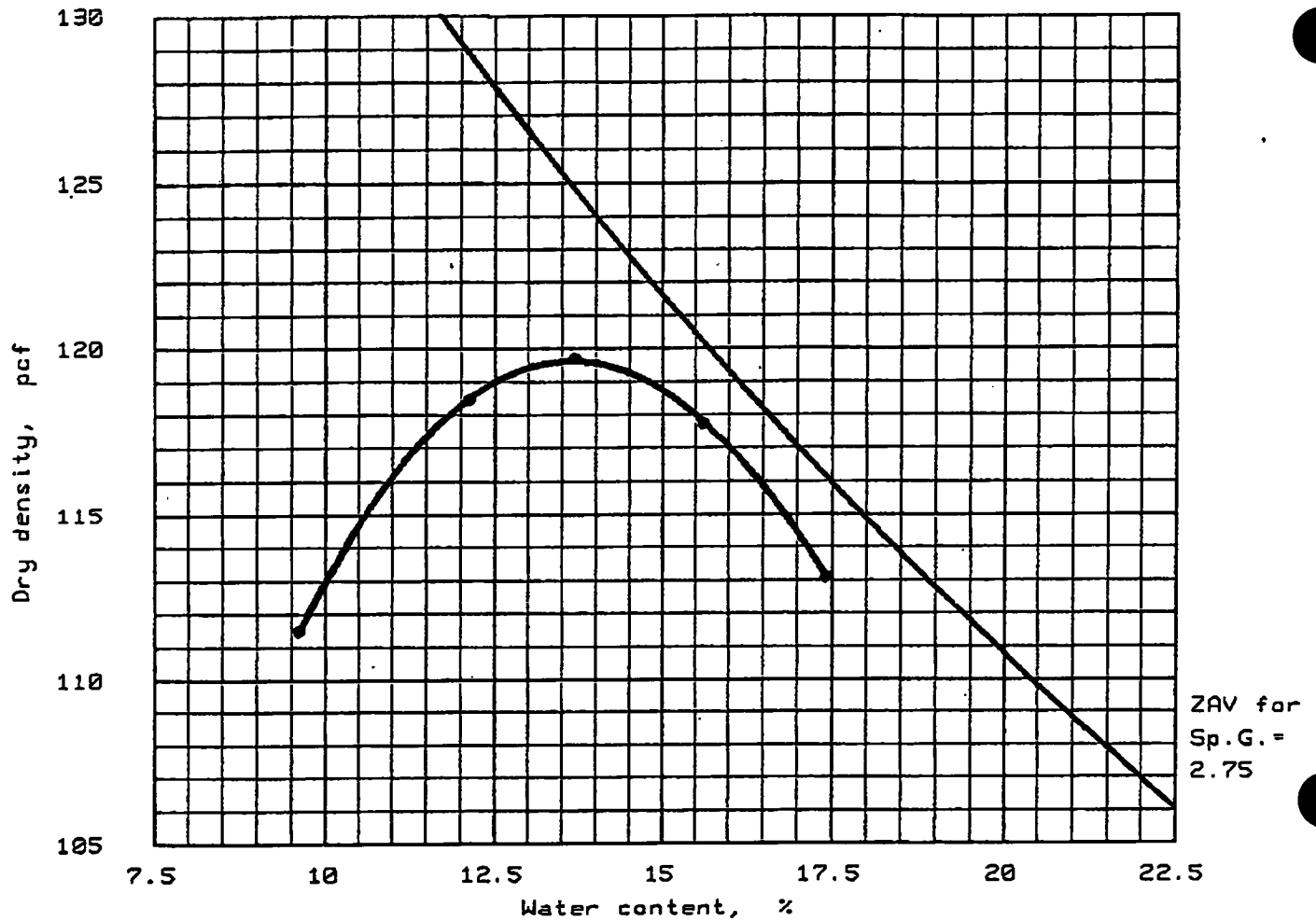
Reviewed by: Donald Mich

Checked by: George P. Schubert

Giles Engineering Assoc., Inc.

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 119.6 pcf

Optimum moisture = 13.6 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
1	CL		14.9 %	2.75	26	11	0.0 %	84.3 %

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay

Cell 2 Floor

Project No.: 1M-920623

Project: BFI-Zion Facility

Client: Donohue and Associates Inc.

Date: 9-11-1992

Remarks:

Reviewed by Donald Mich

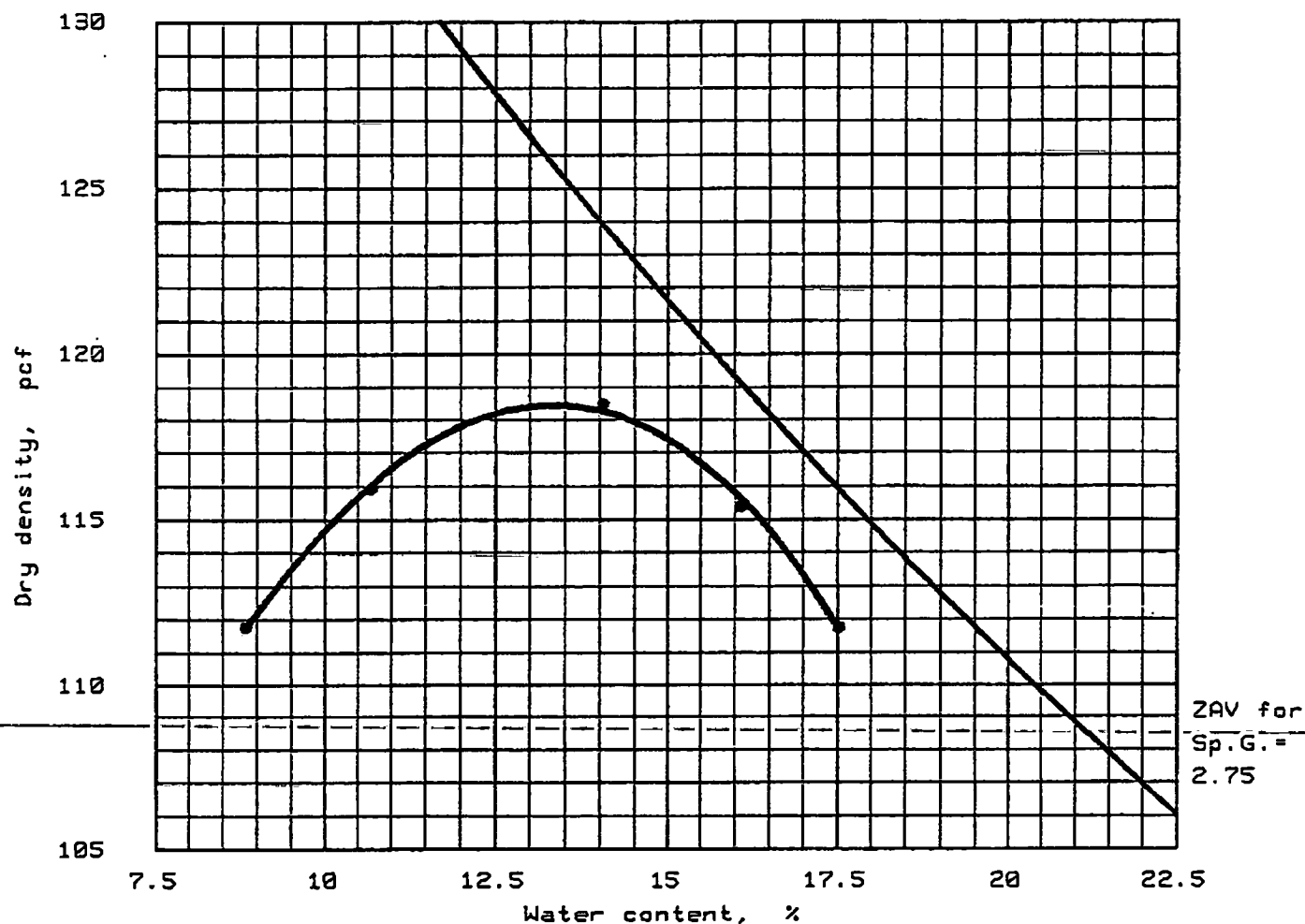
Checked by

Daniel B. Anderson P.E.

Giles Engineering Assoc., Inc.

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 118.5 pcf

Optimum moisture = 13.3 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
2	CL		14.5 %	2.75	25	13	0.0 %	72.0 %

MATERIAL DESCRIPTION

Yellow-Brown and Gray
Silty Clay

SAMPLE LOCATION

Sample No. 2
East Borrow Area

Project No.: 1M-920623
Project: BFI-Zion Facility
Client: BFI Waste Systems

Date: 9-10-1992

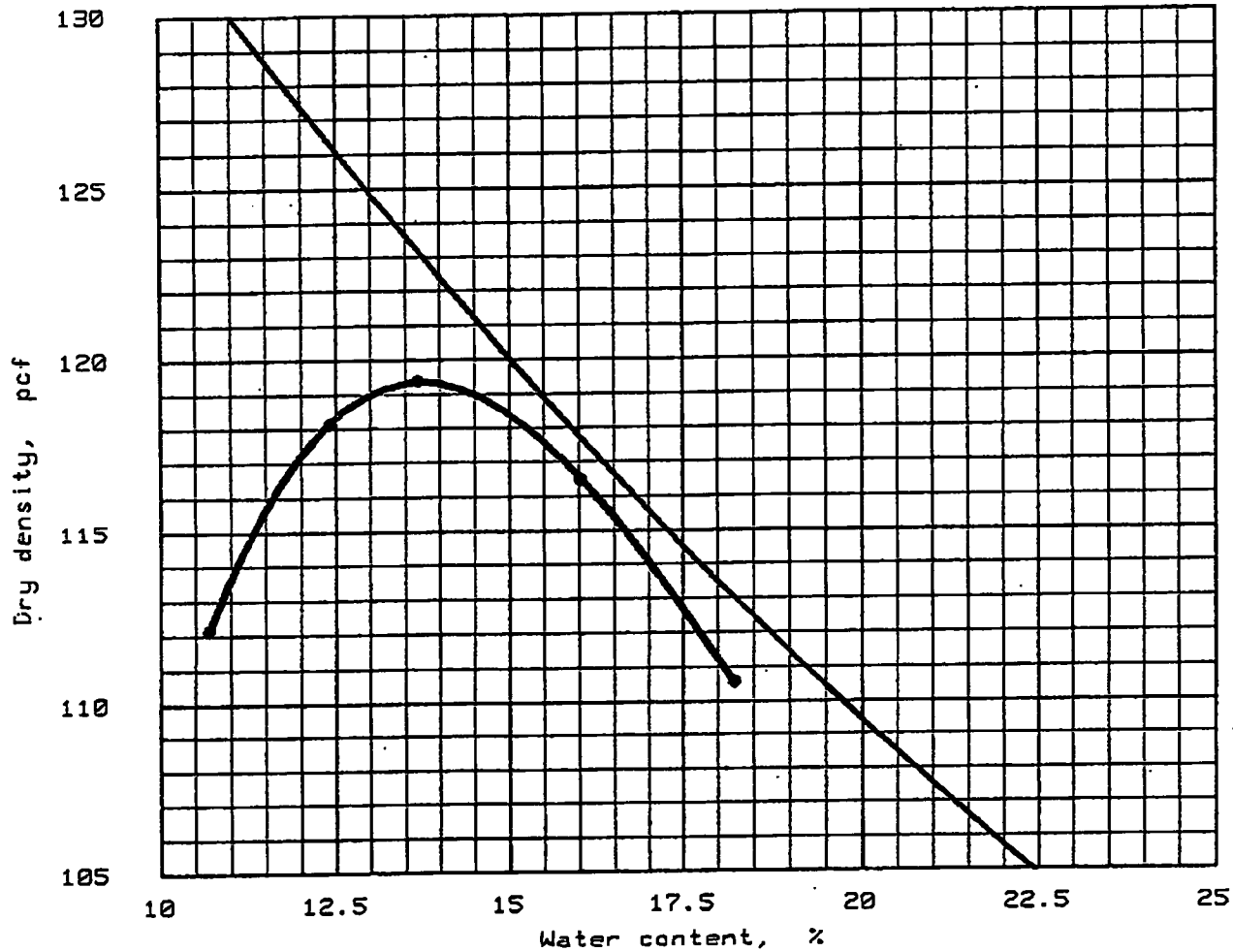
Remarks:
Reviewed by: Donald Mich

Checked by:
George P. Schubert

Giles Engineering Assoc., Inc.

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



ZAV for
Sp.G. =
2.7

"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 119.4 pcf

Optimum moisture = 13.7 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
3	CL		16.6 %	2.7	27	12	0.0 %	88.2 %

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay

111+50N West Edge

Project No.: 1M-920623
Project: BFI- Zion Facility
Client: BFI Waste Systems Inc.

Date: 10-08-1992

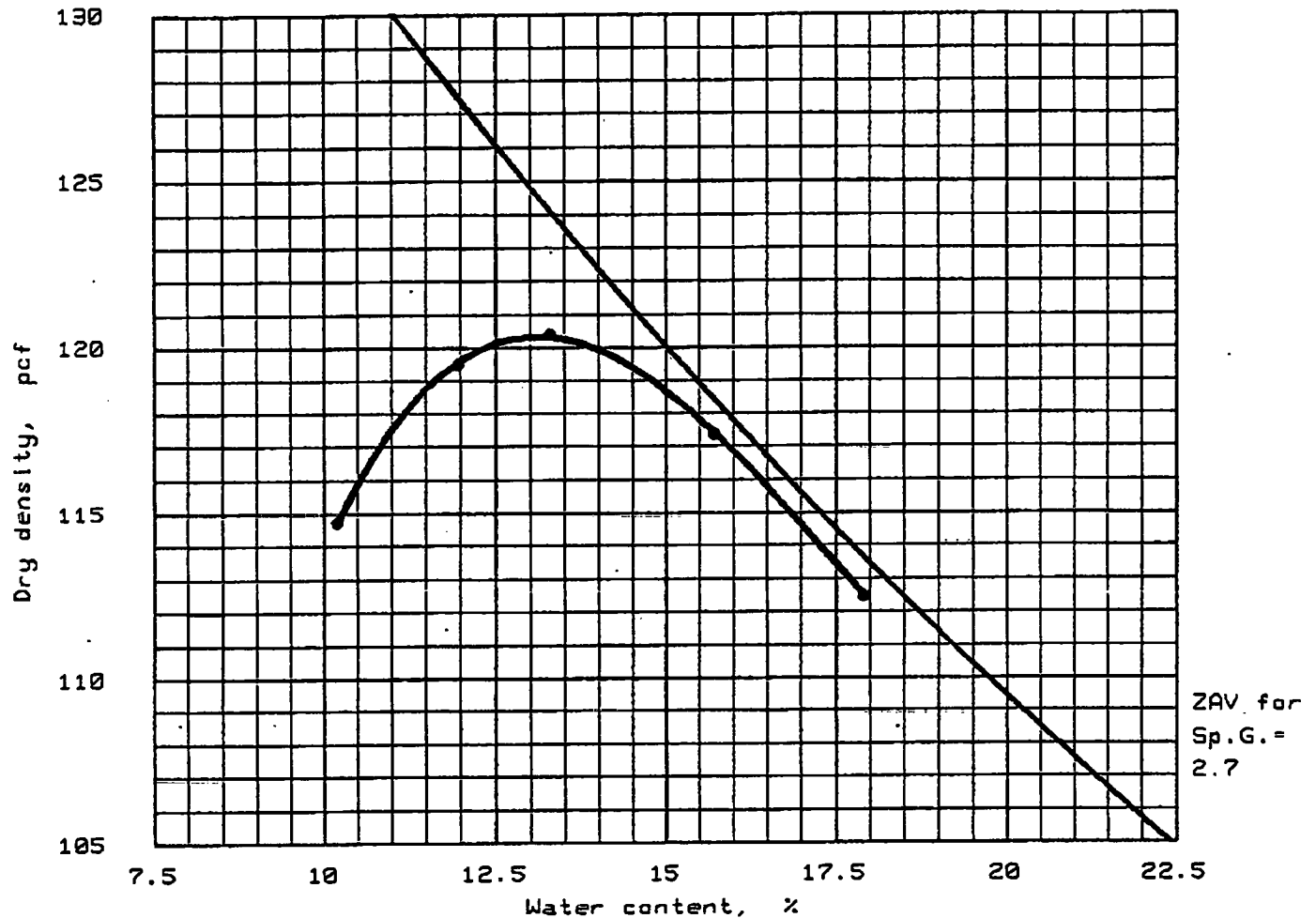
Remarks:

Reviewed by Donald Mich
Checked by
Daniel B. Anderson P.E.

Giles Engineering Assoc., Inc.

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 120.3 pcf

Optimum moisture = 13.1 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
4	CL		15.0 %	2.7	25	12	0.0 %	85.5 %

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay

117+00N

Project No.: 1M-920623
Project: BFI-Zion Facility
Client: BFI Waste Systems

Date: 10-08-1992

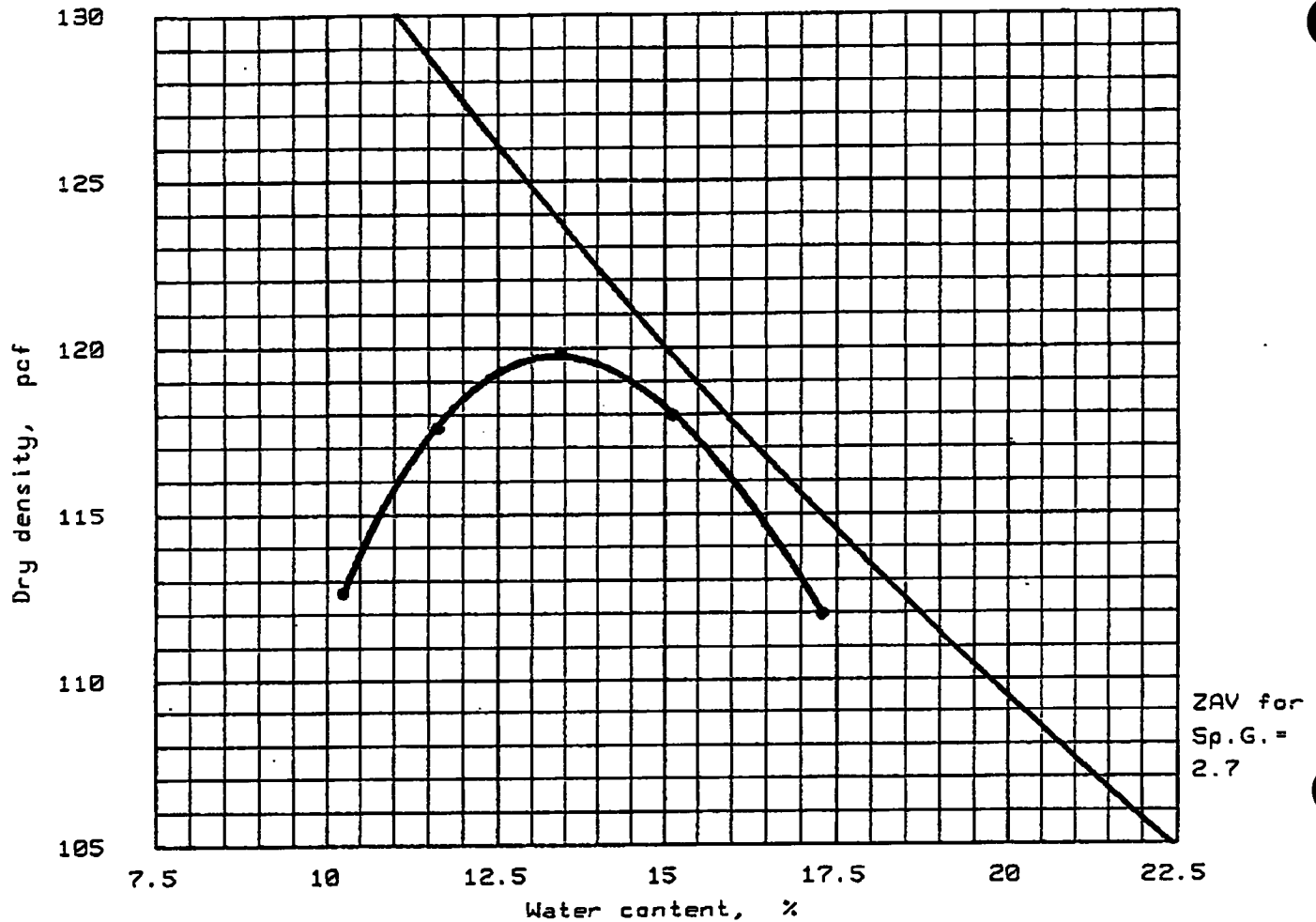
Remarks:

Reviewed by Donald Mich
Checked by
Daniel B. Anderson P.E.

Giles Engineering Assoc., Inc.

Figure No. _____

MOISTURE DENSITY RELATIONSHIP TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Maximum dry density = 119.8 pcf

Optimum moisture = 13.4 %

Soil ID	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
5	CL		15.2 %	2.7	25	11	0.0 %	88.1 %

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay

121+00N

Project No.: 1M-920623

Project: BFI-Zion Facility

Client: BFI Waste Systems Inc.

Date: 10-08-1992

Remarks:

Reviewed by Donald Mich

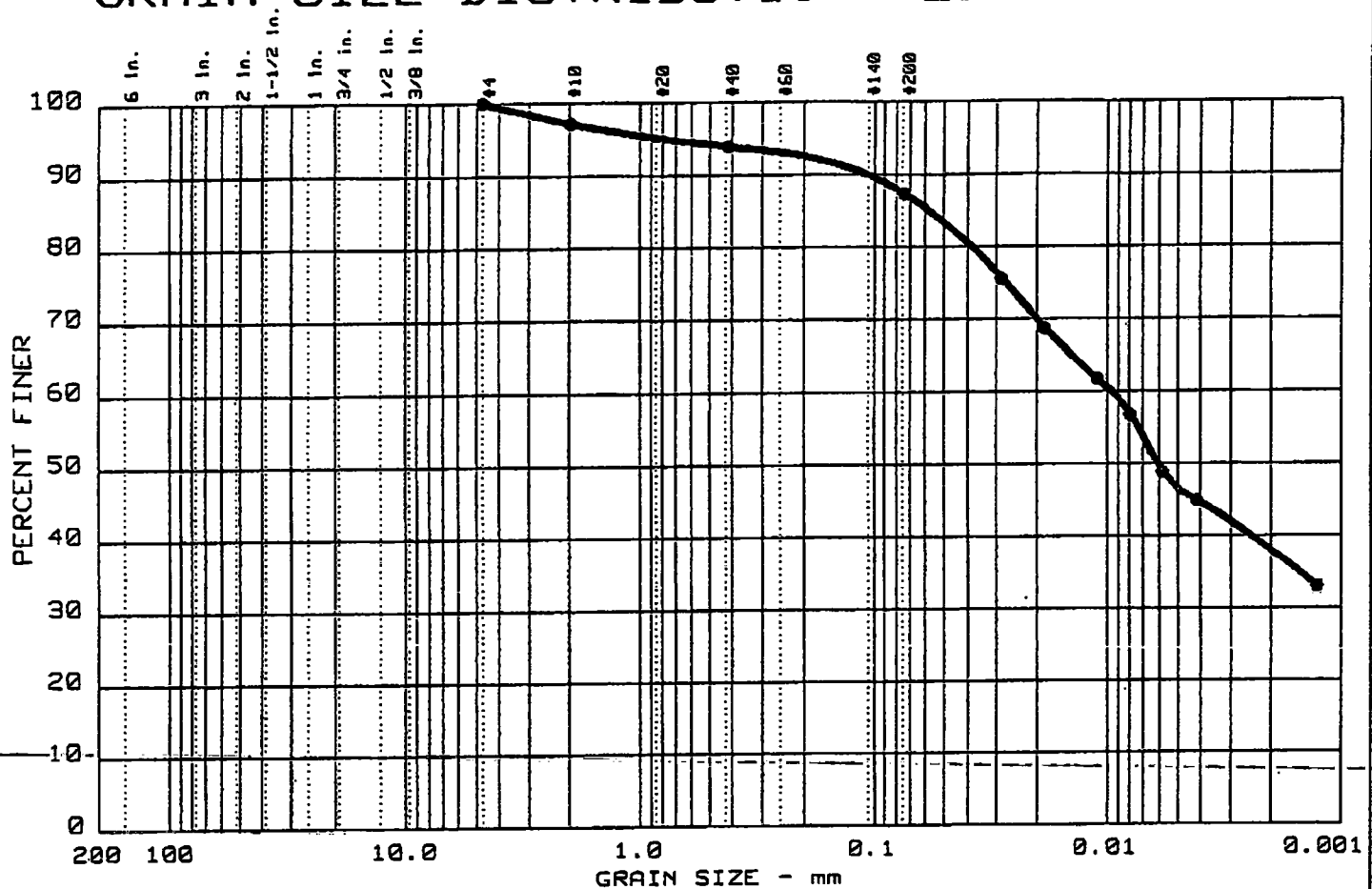
Checked by

Daniel B. Anderson P.E.

Giles Engineering Assoc., Inc.

Figure No. _____

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
• 2	0.0	0.0	12.6	41.2	46.2	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
• 16.2	26	13	13.0	2.7					

MATERIAL DESCRIPTION	SAMPLE LOCATION
• Gray-Brown Silty Clay	• Sample No. 11-R

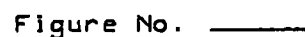
Project No.: 1M-920623
 Project: BFI-Zion Facility
 Client: BFI Waste Systems Inc.

Date: 6-19-92

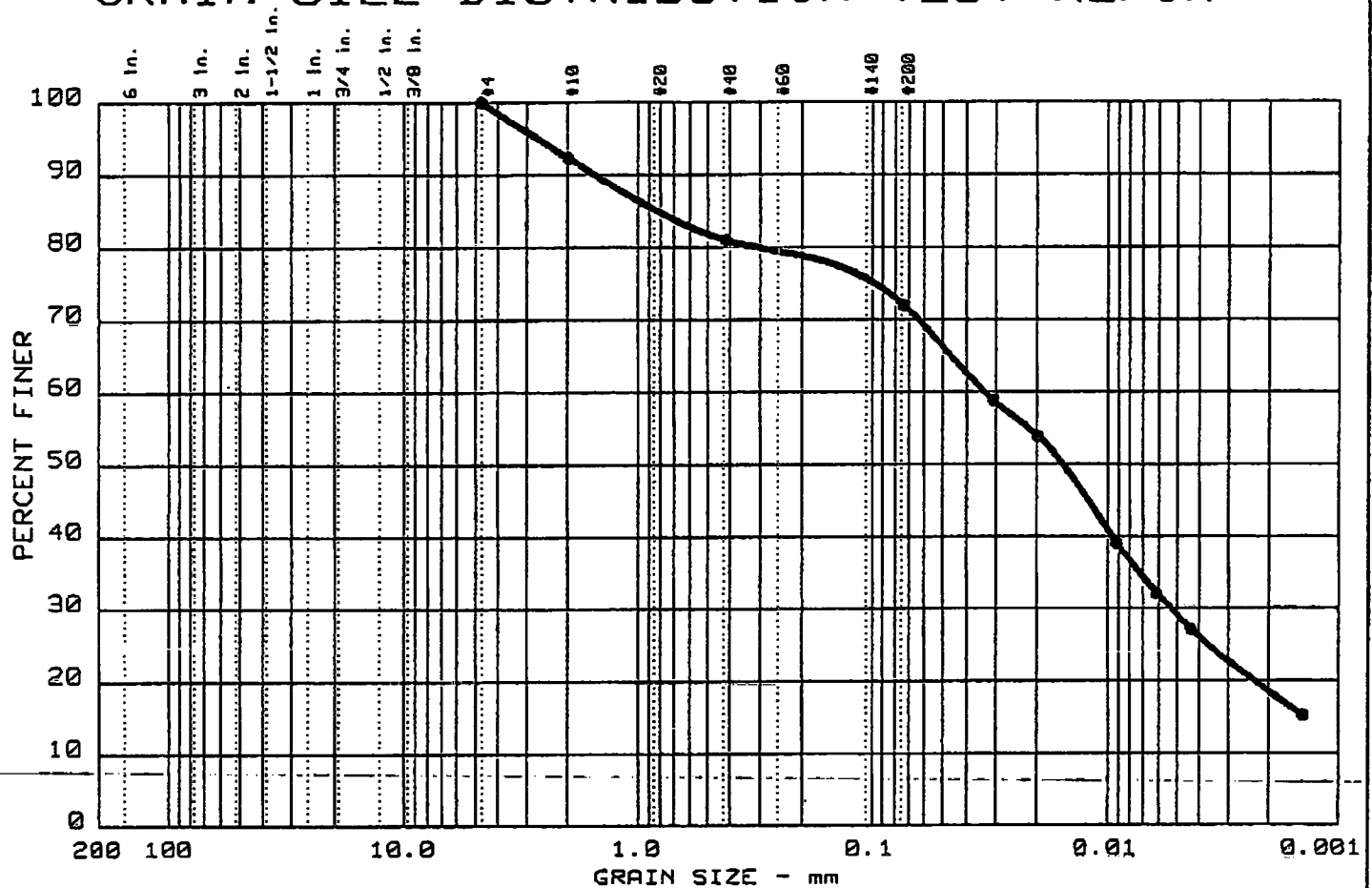
Giles Engineering Assoc., Inc.

Remarks:
 Reviewed by: Donald Mich
 Checked by:
 George P. Schubert

Figure No.



GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
• 14	0.0	0.0	28.0	43.0	29.0	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
• 14.5	25	12	13.0	2.7		0.005			

MATERIAL DESCRIPTION	SAMPLE LOCATION
• Lt. Brown-Gray Silty Clay w/ Sand	• Sample No. 2

Project No.: 1M-920623
 Project: BFI-Zion Facility
 Client: BFI Waste Systems

Date: 9-15-92

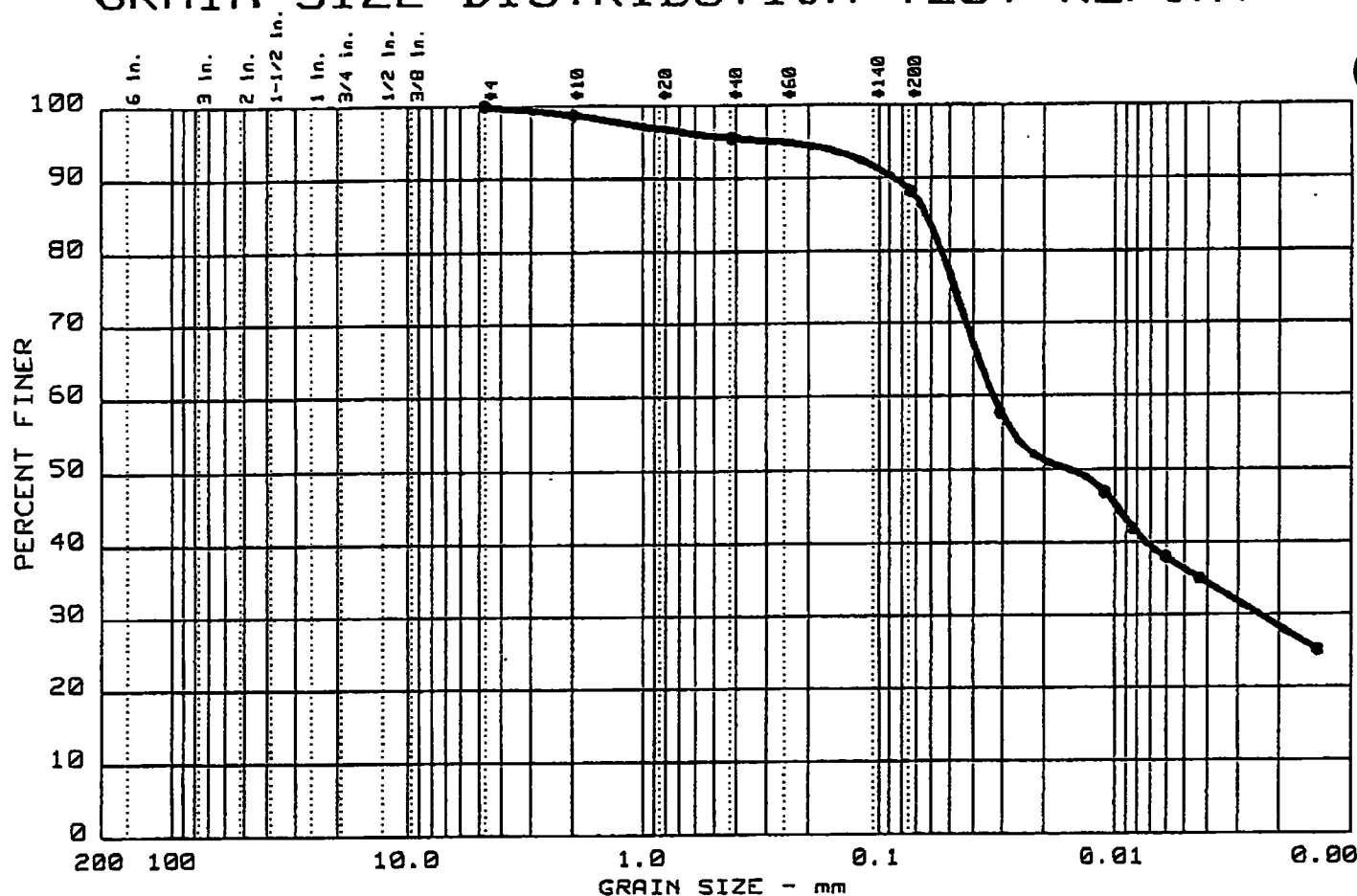
Giles Engineering Assoc., Inc.

Remarks:

Reviewed by Donald Mich
 Checked by
 Daniel B. Anderson P.E.

Figure No. _____

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
• 6	0.0	0.0	11.8	51.9	36.3	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
• 16.6	27	15	12.0	2.7		0.002			

MATERIAL DESCRIPTION	SAMPLE LOCATION
• Gray Silty Clay	• Sample No. 3

Project No.: 1M-920623
 Project: BFI-Zion Facility
 Client: BFI Waste Systems Inc.

Date: 10-14-92

Giles Engineering Assoc., Inc.

Remarks:

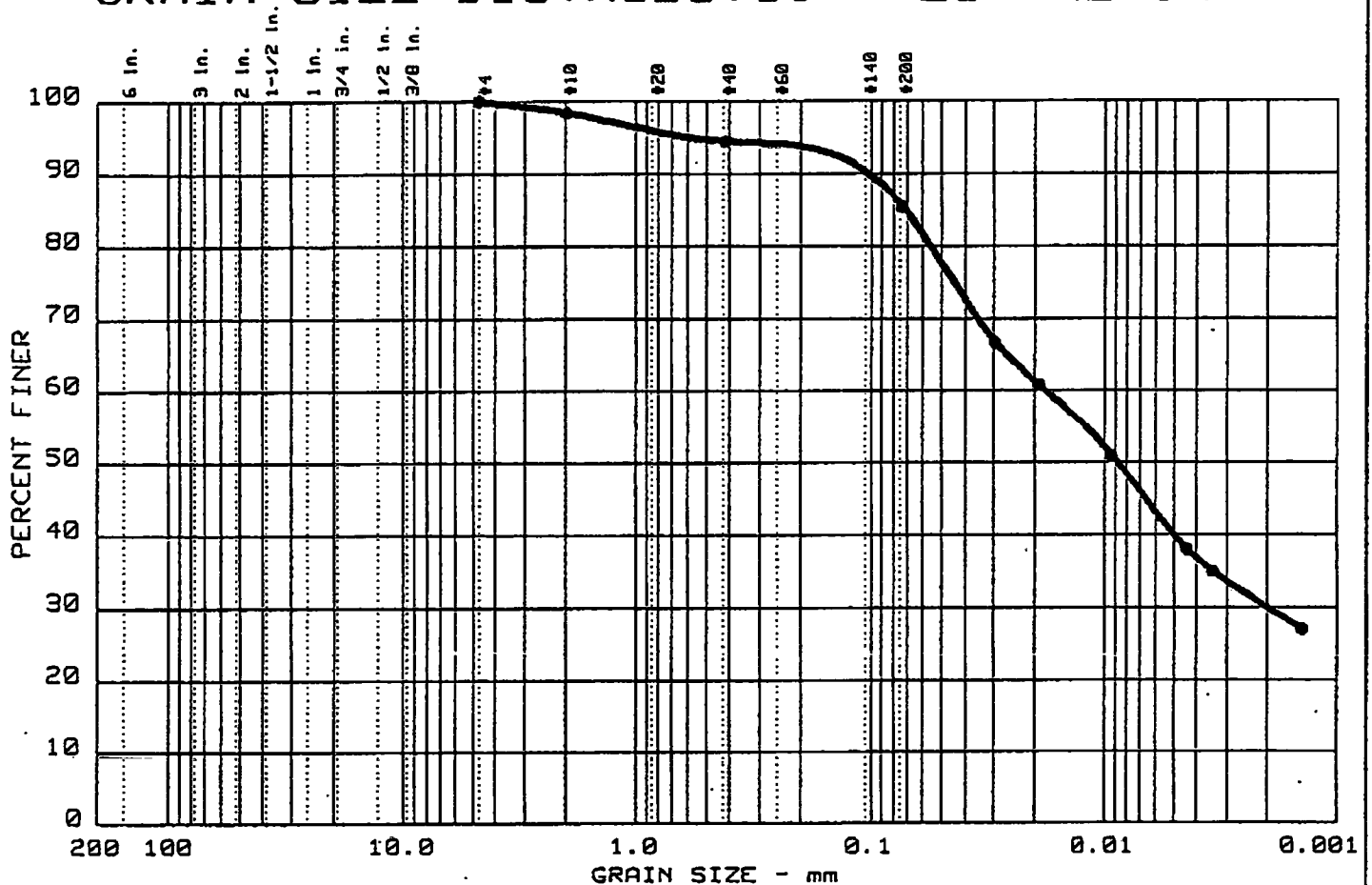
Reviewed by Donald Mich

Checked by

Daniel B. Anderson P.E.

Figure No. _____

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+75	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO
• 7	0.0	0.0	14.5	45.6	39.9	CL	

NM	LL	PL	PI	Sp.Gr.	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
• 15.0	25	12	13.0	2.7		0.002			

MATERIAL DESCRIPTION	SAMPLE LOCATION
• Gray Silty Clay	• Sample No. 4

Project No.: 1M-920623
 Project: BFI-Zion Facility
 Client: BFI Waste Systems Inc.

Date: 10-14-92

Giles Engineering Assoc., Inc.

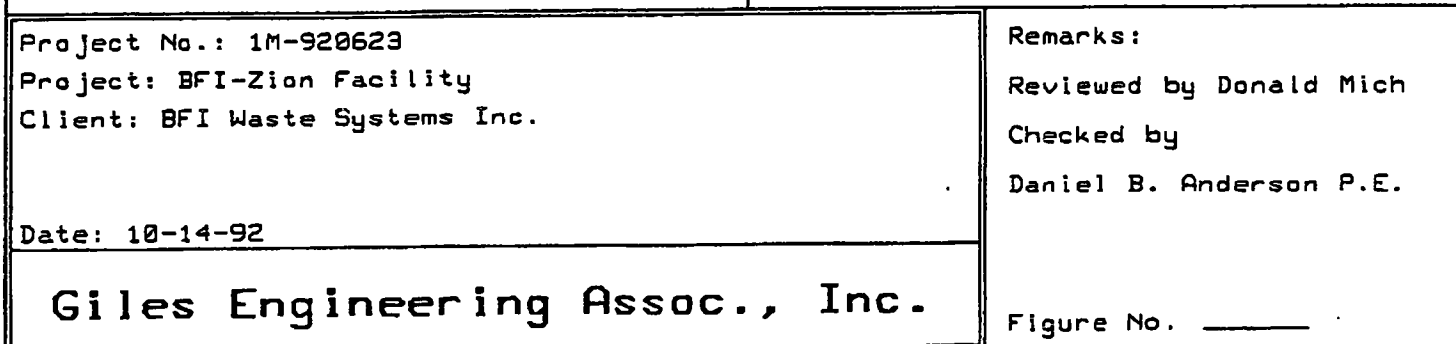
Remarks:

Reviewed by Donald Mich

Checked by

Daniel B. Anderson P.E.

Figure No. _____



REPORT OF FALLING HEAD PERMEABILITY TEST

SAMPLE PREPARATION

SAMPLE HEIGHT (L), cm:	3.05	RIGID WALL CELL NO.:	11
SAMPLE AREA (A), sq. cm:	18.87	PERMEANT FLUID:	Distilled water
BURETTE AREA (a), sq. cm:	0.94	ONE PORE VOLUME, cm:	17.4

TEST DATA

CLOCK TIME 9-9, 9-14	TIME (t) (sec)	BURETTE READING; HEAD (cm)		PERMEABILITY (cm/s) = $2.3(aL/At) * \log_{10}(H_0/H)$
		INITIAL (H ₀)	FINAL (H)	
8:00	60,900	297.35	291.18	5.2x10E-8 1 Pore Volume
4:45	31,500	291.18	286.94	7.1 x 10E-8
8:00	54,600	299.24	291.18	7.6 x 10E-8
5:30	34,200	291.18	286.14	7.7 x 10-8
4:20	30,000	299.50	291.85	7.3 x 10E-8

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 7 \times 10E-8$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
14.0	118.6	72.0	29.0	25	12	13	-----	-----

MATERIAL DESCRIPTION

SAMPLE LOCATION

Yellow-Brown and Gray
Silty Clay

Sample No. 2

East Borrow Area

Project No.: 1M-920623
Project: BFI-Zion Facility

Client: BFI Waste Systems Inc.

Date: 9-24-92

Remarks:

Reviewed by: Donald Mich

Checked by: George P. Schubert

GILES ENGINEERING ASSOCIATES, INC.

REPORT OF FALLING HEAD PERMEABILITY TEST

SAMPLE PREPARATION

SAMPLE HEIGHT (L), cm:	2.03	RIGID WALL CELL NO.:	4
SAMPLE AREA (A), sq. cm:	18.87	PERMEANT FLUID:	Distilled water
BURETTE AREA (a), sq. cm:	0.94	ONE PORE VOLUME, cm:	10.6

TEST DATA

CLOCK TIME 10-5, 10-14	TIME (t) (sec)	BURETTE READING; HEAD (cm)		PERMEABILITY (cm/s) = 2.3 (aL/At) * LOG10 (Ho/H)
		INITIAL (Ho)	FINAL (H)	
8:00	333,000	299.54	293.78	5.9x10E-9 1 Pore Volume
4:30	30,600	293.78	293.24	6.1 x 10E-9
8:00	228,600	293.24	289.42	5.8 x 10E-9
4:00	115,200	289.42	287.48	5.9 x 10E-9
7:45	56,700	287.48	286.56	5.7 x 10E-9

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, K= 6 x 10E-9 cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
16.6	117.6	----	-----	27	15	12	-----	-----

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Sample No. 3

111+50N

West Edge

Project No.: 1M-920623
Project: BFI-Zion Facility

Client: BFI Waste Systems Inc.

Date: 10-14-92

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed by:
Donald Mich

Checked by:
Daniel B. Anderson P.E.

REPORT OF FALLING HEAD PERMEABILITY TEST

SAMPLE PREPARATION

SAMPLE HEIGHT (L), cm: 1.78 RIGID WALL CELL NO.: 7
 SAMPLE AREA (A), sq. cm: 18.87 PERMEANT FLUID: Distilled water
 BURETTE AREA (a), sq. cm: 0.94 ONE PORE VOLUME, cm: 10.5

TEST DATA

CLOCK TIME 10-5, 10-9	TIME (t) (sec)	BURETTE READING; HEAD (cm)		PERMEABILITY (cm/s) = $2.3 (aL/At) * \log_{10} (H_o/H)$
		INITIAL (H _o)	FINAL (H)	
4:30	172,800	299.41	294.88	7.8×10^{-9} 1 Pore Volume
8:20	57,000	294.88	293.32	8.2×10^{-9}
4:30	29,400	293.32	292.52	8.2×10^{-9}
8:00	55,800	292.52	291.05	8.0×10^{-9}
4:30	30,600	291.05	290.21	8.4×10^{-9}

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 8 \times 10^{-9}$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
15.0	119.8	----	-----	25	13	12	-----	-----

MATERIAL DESCRIPTION

SAMPLE LOCATION

Gray Silty Clay

Sample No. 4

117+00N

Project No.: 1M-920623
Project: BFI-Zion Facility

Client: BFI Waste Systems Inc.

Date: 10-14-92

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed by:
Donald Mich

Checked by:
Daniel B. Anderson P.E.

REPORT OF FALLING HEAD PERMEABILITY TEST

SAMPLE PREPARATION

SAMPLE HEIGHT (L), cm: 1.78 RIGID WALL CELL NO.: 1
 SAMPLE AREA (A), sq. cm: 18.87 PERMEANT FLUID: Distilled water
 BURETTE AREA (a), sq. cm: 0.94 ONE PORE VOLUME, cm: 8.5

TEST DATA

CLOCK TIME 10-5, 10-9	TIME (t) (sec)	BURETTE READING; HEAD (cm)		PERMEABILITY (cm/s) = 2.3 (aL/At) * LOG10 (Ho/H)
		INITIAL (Ho)	FINAL (H)	
4:30	172,800	298.49	294.62	6.7x10E-9 1 Pore Volume
8:20	57,000	294.62	293.36	6.7 x 10E-9
4:30	29,400	293.36	292.65	7.3 x 10E-9
8:00	55,800	292.65	291.39	6.9 x 10E-9
4:30	30,600	291.39	290.68	7.1 x 10E-9

AVERAGE STEADY HYDRAULIC CONDUCTIVITY, $K = 7 \times 10E-9$ cm/sec

SAMPLE CHARACTERISTICS

MC	Dd	P200	%Clay	LL	PL	PI	Max. Dd	Opt. Moist.
15.2	115.5	----	-----	25	14	11	-----	-----

MATERIAL DESCRIPTION

Gray Silty Clay

SAMPLE LOCATION

Sample No. 5

121+00N

Project No.: 1M-920623
 Project: BFI-Zion Facility

Client: BFI Waste Systems Inc.

Date: 10-14-92

GILES ENGINEERING ASSOCIATES, INC.

Remarks:

Reviewed by:
 Donald Mich

Checked by:
 Daniel B. Anderson P.E.

Appendix E-3F

Construction Observation Report, Slurry Trench Cutoff Wall, February 1989

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Foth & Van Dyke

R E P O R T

**Construction Observation Report for the
Winthrop Harbor Waste Management Facility
Slurry Trench Cutoff Wall**

Scope I.D.: 88B59

Browning-Ferris Industries of Illinois

February 1989

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**CONSTRUCTION OBSERVATION REPORT FOR THE
WINTHROP HARBOR WASTE MANAGEMENT FACILITY
SLURRY TRENCH CUTOFF WALL**

Prepared for:

Browning-Ferris Industries of Illinois, Inc.

Prepared by:

**FOTH & VAN DYKE and Associates Inc.
2737 South Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012**

FEBRUARY 1989

Foth & Van Dyke

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414/497-2500
602100 V

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APPENDIX F	Resident Inspection Reports
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APPENDIX H	Laboratory Grain Size and Atterberg Limits Tests Results
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LIST OF PHOTOS

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1	Box used to mix dry bentonite with fresh water under high pressure prior to being pumped to holding pond. December 1988.
2	View of construction work pad with backhoe in operation. Looking west with machine at station 1+00E. December 1988.
3	A three foot level mounted on backhoe's counter weight. To verify verticality of slurry cutoff wall. Checked after each movement of backhoe. December 1988.
4	Backhoe on construction pad with ten foot offset markers. Looking north (approximate) station 8+00S. December 1988.
5	Backfill profile being checked from station 3+80S to station 5+60S. Looking south from (approximate) station 4+00S. December 1988.
6	Pumped slurry from holding pond being discharged into the trench at station 0+00E. Looking east. December 1988.
7	Backhoe at station 3+00S moving southward. Slurry level at approximately two feet from top of construction pad. Note: the turn of the trench at station 1+96E. December 1988.

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- 8 Trench filled with slurry. Looking north from (approximate) 7+00S. Note: the excavated material placed away from face of trench. December 1988.
- 9 D6 Cat Dozer mixing backfill material. Excavated material, dry bentonite, clay from Borrow No. 2, and fresh slurry are mixed on pad. Looking northwest (approximate) station 3+50S. December 1988.
- 10 D6 Cat Dozer pushing mixed backfill into trench from the "daylight" of backfill. Looking north from (approximate) station 6+00S. December 1988.
- 11 Corner of trench at station 1+96E which equals 2+30S. The view of the six foot overlap (northend of project) looking south. December 1988.
- 12 Top of trench cave-in from station 0+00E to station 0+60E. Contractor re-excavated area to remove frozen material. Looking to the east. December 1988.

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1.0 INTRODUCTION

1.1 General Site Information

The Winthrop Harbor Waste Management Facility is located in the NW 1/4 of Section 7, Township 46N, Range 12E, Lake County, Illinois. The site is bordered on the west by Green Bay Road and on the south by Ninth Street. The facility is owned and operated by Browning-Ferris Industries of Illinois, Inc. (BFI), and is used for disposal of hazardous and nonhazardous waste.

1.2 Project History

The total Winthrop Harbor facility property encompasses approximately 150 acres. Of the total, 74.53 acres are used for management of RCRA Hazardous Waste and are the subject of the permit issued by the Illinois Environmental Protection Agency (IEPA). These 74.53 acres are designated by the IEPA as Winthrop Harbor Site No. 1, IEPA ID No. 0978020001 and United States Environmental Protection Agency (USEPA) ILD No. 980700728. The remaining acres are used for nonhazardous waste disposal. The 75 acres used for nonhazardous waste disposal are designated by the IEPA as Winthrop Harbor Site No. 2, IEPA ID No. 0978020002.

Winthrop Harbor Site No. 1 located at the Winthrop Harbor facility received a development permit in August 1976 from the IEPA. That permit allowed disposal of municipal, commercial, industrial, and hazardous waste in a 59-acre area in Benton Township. The remaining 16 acres are located in Newport township and are currently used for ancillary facilities. The Existing Hazardous Waste Management Unit (a 49-acre portion of the 59 acres) in Benton Township has been in use since August 1976 as a disposal area for municipal, commercial, and industrial wastes, including hazardous wastes. At the present

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time, the Existing Hazardous Waste Management Unit receives RCRA hazardous waste and a limited amount of nonhazardous industrial waste (IEPA "special waste"). The Existing Hazardous Waste Management Unit accepts mainly sludges from electroplating operations and other sludges that are hazardous due to their heavy metal content.

The future hazardous waste management operation calls for the use of approximately ten acres remaining in the 59-acre portion. The future landfill portion of the operation will be built in two phases and will include two hazardous waste landfill cells meeting the Hazardous and Solid Waste Amendments (HSWA) of 1984 minimum technology requirements for construction of those type units. In addition, proposed operations include the operation of a Quality Control Area (drum staging, truck wash, laboratory and unloading area) and leachate collection tanks located on portions of the 16 acres in Newport Township.

1.3 Purpose and Scope

This report ^{and the appendices} ~~and accompanying Drawing Nos. A-1 and A-2~~ summarize the observations related to the slurry cutoff wall construction activities at the Winthrop Harbor Landfill. Construction of the slurry trench cutoff wall was done by Case International Company of Roselle, Illinois. Construction observation was performed by Foth & Van Dyke and Associates Inc. (F&VD) of Green Bay, Wisconsin. The slurry cutoff wall is located between the existing codisposal unit and the future secure cells. ~~We understand that~~ The primary purpose of the cutoff wall is to ~~relieve the seepage pressures on the proposed secure cell excavations.~~ control lateral flow of groundwater during cell preparation.

To verify that construction was completed in substantial compliance with the designs, the report includes trench slurry test results, backfill test results, photo documentation, and

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visual classification of the key-in material for the wall.
Record drawings depicting conditions after construction are also
~~incorporated by reference into this report~~ appended to this
report.

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2.0 DESIGN AND QUALITY ASSURANCE MANUAL

STS Consultants, at the request of Case International, performed a subsurface exploration along the centerline of the slurry wall. Based on this data and test results on different backfill mix designs, they concluded that 1) the bottom of trench shall have a maximum elevation of 718.0 feet above mean sea elevation, and 2) the backfill shall consist of a homogeneous mixture of the excavated material and clay from Borrow Area No. 2 at the site mixed in the ratio 100:20, one percent bentonite and sufficient slurry from the trench to achieve a slump of four to six inches. The design report from STS Consultants is given in Appendix A.

Foth & Van Dyke prepared a Quality Assurance Manual for the project based on the specifications prepared by BFI and the verbal information on the mix design available from time to time. This manual, given in Appendix B, was used by the Foth & Van Dyke site engineer during the construction.

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3.0 CUTOFF WALL CONSTRUCTION

3.1 Pre-Excavation Activities

A construction pad was constructed by BFI. Clay material was hauled from the on-site borrow pit using ~~8~~27 Cat Scrapers and compacted with a Cat 815 sheepsfoot in lifts no greater than 12 inches prior to compaction. The top of the construction pad was constructed at elevation 759.40 feet from station 0+00E to 4+00S. From station 4+00S, the construction pad was sloped at a 1.95 percent grade to station 13+25S, which was the end of the slurry cutoff wall.

Surveying control was provided by BFI. The slurry wall alignment was staked by BFI and the resident engineer. The slurry wall location is shown on Drawing No. A-1 in Appendix C. A construction offset line which paralleled the wall was placed at a distance of 20 feet. The offset line was staked every 50 feet as was the wall center line.

The bench mark used for vertical control was the top of steel casing for monitoring well G127 (elevation = 759.60 feet). The centerline of the wall was shot every ten feet on top of the pad prior to construction. The depth of the key was measured from the construction pad, whose elevation was known.

3.2 Discussion of Excavation Activities

3.2.1 General

The contractor (Case International of Roselle, Illinois) mobilized on the site on December 16, 1988, and constructed a mixing box and a holding pond for the trench slurry. Pumps were installed at the mixing box and the holding pond. Slurry transfer pipes were then installed to the start of the slurry cutoff wall at station 0+00E.

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3.2.2 Bentonite Slurry

To obtain a stabilized bentonite-water slurry, the bentonite powder was mixed with water in a colloidal mixer. This mixing procedure achieved complete dispersion of the bentonite particles in the water. The bentonite content of the slurry was a minimum of four percent by weight of water. After mixing, the bentonite-water slurry was allowed to hydrate in the holding pond prior to introduction into the trench. The bentonite-water slurry was agitated in the holding pond by having the pump circulate the bentonite-water slurry. The bentonite was a pulverized, premium grade natural sodium bentonite and met API specification 13A.

3.2.3 Trench Excavation

The contractor began excavation for the slurry cutoff wall on December 17, 1988. A lead-in trench was started approximately 65 feet west of station 0+00E. This trench had a gradual slope from the top of the construction pad to the start of the wall key-in. Bentonite-water slurry was introduced into the lead-in trench once the trench depth reached six feet. The bentonite-water slurry was maintained at a depth of two feet or less from the top of the construction pad during excavation.

The trench was excavated vertically from the construction pad to varying depths in order to provide a key of at least three feet into the underlying natural impervious strata. Further, the bottom of the cutoff wall was at a maximum elevation of 718.00 feet above mean sea level. The cutoff wall was excavated in a continuous fashion using a 1066 Koehring backhoe, with a three-foot-wide bucket. The vertical wall alignment did not deviate more than three percent. This was checked by placing a level on the backhoe's counterweight. If the machine was level, the boom

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was digging vertically. The level was checked whenever the backhoe was moved. The total length of the slurry cutoff wall was 1,297 feet. The depth of the trench ranged from 30 to 46 feet with an average depth of 35 feet.

With the top of impervious natural strata running well above the 721-foot elevation (718 + 3 feet), the contractor excavated the trench to a depth where the bottom of the key would be at or near the 718.00-foot elevation. The trench profile is shown on Drawing No. A-2 in Appendix C. The elevation of the pad was shot every ten feet prior to construction. A weighted reinforced cloth tape was used to measure the depths to the bottom of the key. From the above data the elevations of the bottom of the key were determined. The observations are shown in Table No. 3-1.

Samples of the key material were taken as construction progressed. Sampling and testing of the key material are described in Section 3.7.1.

The wall alignment was designed to be fairly straight. At station 7+06S where monitoring well No. 111 is located, the separation distance between the centerline of wall and the centerline of the well was 13 feet. A minimum separation distance of ten feet was specified in the design. The slurry cutoff wall was extended straight to station 9+00S. From this point the alignment was changed by BFI in order to go as far east as possible such that the track of the backhoe would follow the toe of the codisposal area. By the time the contractor was at station 9+40S, waste was encountered in the excavation.

The thickness of the waste layer averaged (18 to 20) feet during the rest of the excavation. The excavated wastes were loaded by the backhoe into Cat scrapers and hauled to the hazardous waste disposal site by BFI personnel.

TABLE NO. 3-1

Visual Classification of Key-In Material
Construction Documentation of Cutoff Wall
Winthrop Harbor Landfill

Station	Clay Pad (Elev.)	Top of Key (Elev.)	Bottom of Key (Elev.)	Visual Class of Key Soil	Top of Clay (Elev.)	Comments
0+00E	759.8	716.8	713.8	Lean Clay (CL)	744.4	
0+20E	759.7	716.6	713.1	Lean Clay (CL)		
0+40E	759.5	717.5	714.5	Lean Clay (CL)		
0+60E	759.4	717.4	714.4	Lean Clay (CL)		
0+70E	759.4	713.4	713.4	Lean Clay (CL)		
0+80E	759.4	716.4	713.4	Lean Clay (CL)		
0+90E	759.4	715.9	712.9	Lean Clay (CL)		
1+00E	759.4	719.4	716.4	Lean Clay (CL)	744.4	
1+10E	759.4	718.4	714.9	Lean Clay (CL)		
1+20E	759.4	720.4	717.4	Lean Clay (CL)		
1+30E	759.4	719.9	715.6	Lean Clay (CL)		
1+40E	759.4	718.4	714.1	Lean Clay (CL)		
1+50E	759.4	721.0	717.8	Lean Clay (CL)		
1+60E	759.4	721.0	717.9	Lean Clay (CL)		
1+70E	759.4	718.9	715.4	Lean Clay (CL)		
1+80E	759.4	719.4	716.4	Lean Clay (CL)		
1+96E	759.4	720.3	717.4	Lean Clay (CL)		1+96E = 2+30S with 6' overlap station equation
2+24S	759.4	720.4	717.4	Lean Clay (CL)		
2+30S	759.4	721.0	717.4	Lean Clay (CL)		
2+40S	759.4	721.0	717.5	Lean Clay (CL)		
2+50S	759.4	720.1	717.1	Lean Clay (CL)		
2+60S	759.4	719.4	717.1	Lean Clay (CL)		
2+70S	759.4	719.9	715.3	Lean Clay (CL)		
2+80S	759.4	719.9	716.6	Lean Clay (CL)		
2+90S	759.4	719.3	715.6	Lean Clay (CL)		
3+00S	759.4	719.4	715.9	Lean Clay (CL)	744.4	
3+10S	759.4	718.9	715.5	Lean Clay (CL)		
3+20S	759.4	719.9	716.7	Lean Clay (CL)		

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TABLE NO. 3-1 (Cont.)

Station	Clay Pad (Elev.)	Top of Key (Elev.)	Bottom of Key (Elev.)	Visual Class of Key Soil	Top of Clay (Elev.)	Comments
3+30S	759.4	721.0	718.0	Lean Clay (CL)		
3+40S	759.4	720.4	717.3	Lean Clay (CL)		
3+50S	759.4	719.7	716.4	Lean Clay (CL)		
3+60S	759.4	719.7	716.7	Lean Clay (CL)		
3+70S	759.4	720.9	717.9	Lean Clay (CL)		
3+80S	759.4	719.7	716.7	Lean Clay (CL)		
3+90S	759.4	717.3	716.1	Lean Clay (CL)		
4+00S	759.4	719.5	716.4	Lean Clay (CL)		
4+10S	759.4	720.3	717.4	Lean Clay (CL)		
4+20S	759.0	721.0	718.0	Lean Clay (CL)		
4+30S	758.9	720.9	717.8	Lean Clay (CL)		
4+40S	758.7	720.5	717.7	Lean Clay (CL)		
4+50S	758.6	719.9	716.6	Lean Clay (CL)	726.6	
4+60S	758.6	720.1	716.3	Lean Clay (CL)		
4+70S	758.4	720.4	716.8	Lean Clay (CL)		
4+80S	758.3	721.0	717.8	Lean Clay (CL)		
4+90S	758.1	720.9	717.6			
5+00S	757.9	720.1	716.9			
5+10S	757.8	720.3	717.1	Lean Clay		
5+20S	757.6	719.6	716.3	Lean Clay w/Silt (CL)		
5+30S	757.3	719.3	715.8	Lean Clay w/Silt (CL)		
5+40S	757.3	721.0	717.0	Lean Clay w/Silt (CL)		
5+50S	757.0	721.0	717.0	Lean Clay w/Silt (CL)	737.0	
5+60S	756.8	721.0	717.0	Lean Clay w/Silt (CL)		
5+70S	756.8	720.5	716.8	Lean Clay w/Silt (CL)		
5+80S	756.8	720.1	716.5	Lean Clay w/Silt (CL)		
5+90S	756.6	720.1	716.6	Lean Clay w/Silt (CL)		

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TABLE NO. 3-1 (Cont.)

Station	Clay Pad (Elev.)	Top of Key (Elev.)	Bottom of Key (Elev.)	Visual Class of Key Soil	Top of Clay (Elev.)	Comments
6+00S	756.6	719.6	716.6	Lean Clay w/Silt (CL)		
6+10S	756.5	720.2	717.4	Lean Clay (CL)		
6+20S	756.0	719.2	716.0	Lean Clay w/Silt (CL)		
6+30S	755.8	720.6	715.8	Lean Clay w/Silt (CL)		
6+40S	755.7	720.2	715.4	Lean Clay w/Silt (CL)		
6+50S	755.8	720.5	716.8	Lean Clay w/Silt (CL)		
6+60S	755.5	720.1	716.5	Lean Clay w/Silt (CL)		
6+70S	754.8	718.8	715.8	Lean Clay w/Silt (CL)		
6+80S	754.2	718.2	715.2	Lean Clay w/Silt (CL)		
6+90S	753.7	717.7	714.7	Lean Clay w/Silt (CL)		
7+00S	753.2	717.2	714.2	Lean Clay w/Silt (CL)	733.2	
7+10S	753.2	717.2	714.2	Lean Clay w/Silt (CL)		
7+20S	753.4	718.4	715.4	Lean Clay w/Silt (CL)		
7+30S	753.5	718.5	715.5	Lean Clay w/Silt (CL)		
7+40S	753.5	718.5	715.5	Lean Clay w/Silt (CL)		
7+50S	753.7	719.7	716.7	Lean Clay w/Silt (CL)		
7+60S	753.3	719.3	716.3	Lean Clay (CL)		
7+70S	753.0	719.0	716.0	Lean Clay (CL)		
7+80S	752.7	719.2	715.7	Lean Clay (CL)		
7+90S	752.5	717.5	714.7	Lean Clay (CL)		
8+00S	752.3	718.3	715.3	Lean Clay (CL)		
8+10S	752.0	718.0	715.0	Lean Clay (CL)		
8+20S	751.7	717.7	714.7	Lean Clay (CL)		
8+30S	751.4	717.4	714.4	Lean Clay (CL)		
8+40S	751.1	716.1	713.1	Lean Clay (CL)		
8+50S	750.0	718.0	715.0	Lean Clay (CL)		
8+60S	750.6	717.7	714.7	Lean Clay (CL)		
8+70S	750.2	718.2	715.2	Lean Clay (CL)		
8+80S	749.9	717.9	714.9	Lean Clay (CL)		
8+90S	749.8	716.8	713.7	Lean Clay (CL)		

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TABLE NO. 3-1 (Cont.)

Station	Clay Pad (Elev.)	Top of Key (Elev.)	Bottom of Key (Elev.)	Visual Class of Key Soil	Top of Clay (Elev.)	Comments
9+00S	749.1	718.1	715.1	Lean Clay (CL)		
9+10S	749.1	718.1	715.1	Lean Clay (CL)		
9+20S	748.8	717.8	714.8	Lean Clay (CL)		
9+30S	748.7	719.7	716.7	Lean Clay (CL)		
9+40S	749.1	719.1	716.1	Lean Clay (CL)	721.1	Top of waste = 741.1, bottom of waste = 721.1
9+50S	749.3	719.3	716.3	Lean Clay (CL)		
9+60S	749.0	718.8	715.8	Lean Clay (CL)		
9+70S	748.8	718.8	715.8	Lean Clay (CL)		
9+80S	748.8	718.8	715.8	Lean Clay (CL)		
9+90S	749.0	718.8	716.0	Lean Clay (CL)		
10+00S	748.8	718.8	715.8	Lean Clay (CL)	720.8	Top of waste = 738.8, bottom of waste = 720.8
10+10S	748.7	718.7	715.7	Lean Clay (CL)		
10+20S	748.8	718.8	715.8	Lean Clay (CL)		
10+30S	748.3	718.3	715.3	Lean Clay (CL)		
10+40S	747.9	718.9	715.9	Lean Clay (CL)	719.4	Top of waste = 737.9, bottom of waste = 719.9
10+50S	747.4	718.4	715.4	Lean Clay (CL)		
10+60S	747.2	719.2	716.2	Lean Clay (CL)		
10+70S	747.2	718.2	715.2	Lean Clay (CL)		
10+80S	747.1	720.1	717.1	Lean Clay (CL)	720.9	Top of waste = 737.0, bottom of waste = 721.0
10+90S	747.0	720.0	717.0	Lean Clay (CL)		
11+00S	746.9	720.4	716.9	Lean Clay (CL)		
11+10S	746.6	719.6	716.6	Lean Clay (CL)		
11+20S	746.3	718.3	715.3	Lean Clay (CL)		
11+30S	745.9	717.9	714.9	Lean Clay (CL)		
11+40S	745.6	718.6	715.6	Lean Clay (CL)		Top of waste = 737.6, bottom of waste = 724.6
11+50S	745.5	717.5	714.5	Lean Clay (CL)		
11+60S	745.5	717.5	714.5	Lean Clay (CL)		
11+70S	745.5	717.5	714.5	Lean Clay (CL)		Top of waste = 739.5, bottom of waste = 725.5
11+80S	745.4	718.4	714.4	Lean Clay (CL)		
11+90S	745.2	718.2	715.2	Lean Clay (CL)		

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TABLE NO. 3-1 (Cont.)

Station	Clay Pad (Elev.)	Top of Key (Elev.)	Bottom of Key (Elev.)	Visual Class of Key Soil	Top of Clay (Elev.)	Comments
12+00S	744.9	717.9	714.9	Lean Clay (CL)		
12+10S	744.5	712.5	709.5	Lean Clay (CL)		Top of waste = 739.5, bottom of waste = 723.5
12+20S	744.3	712.3	709.3	Lean Clay (CL)		
12+30S	744.0	716.0	713.0	Lean Clay (CL)		
12+40S	743.3	715.4	712.4	Lean Clay (CL)		
12+50S	743.0	715.0	712.0	Lean Clay (CL)		Top of waste = 738.0, bottom of waste = 723.0
12+60S	742.9	716.9	712.9	Lean Clay (CL)		
12+70S	742.3	716.3	712.3	Lean Clay (CL)		
12+80S	742.0	716.0	712.0	Lean Clay (CL)		
12+90S	742.0	716.0	712.0	Lean Clay (CL)		
13+00S	741.8	713.8	710.8	Lean Clay (CL)		Top of waste = 739.0, bottom of waste = 721.0
13+10S	741.8	713.8	710.8	Lean Clay (CL)		
13+20S	741.8	713.8	710.8	Lean Clay (CL)		
13+25S	741.8	713.8	710.8	Lean Clay (CL)		

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Discuss

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At station 11+75S the backhoe hit a leachate drain line. There was a little loss in the bentonite-water slurry; we assumed it filled the leachate storage tank at the southwest corner of the codisposal area. We pulled the tank cover and the tank was found to be filled. The leachate line, which is outside of the codisposal site, was to have extended 200 feet straight north of the end of the storage tank. Apparently when the line was installed, it was not straight north, but ran at an angle toward the northwest.

The slurry cutoff wall was terminated at station 13+25S. The backhoe remained in digging position to remove any material which the slurry backfill was pushing along.

When the trenching was complete, the area where the scrapers were being loaded had wastes which spilled from the scrapers. BFI removed the spilled wastes using an ~~873~~ Cat loader which piled the material. A 225 Cat backhoe was used to load the scrapers which transported the wastes to the hazardous waste disposal area.

3.3 Discussion of Backfill Methods

The backfilling operation commenced on December 20, 1988. The impervious backfill was placed into the trench after excavation. The mix consisted of excavated material, clay from Borrow Area No. 2, and dry bentonite mixed with both fresh slurry and trench slurry. The primary source of borrow material was the construction pad itself. Because of this, the amount of borrow material being added to the backfill was difficult to control. In order to monitor the amount of borrow being added, field sieve analyses were run on the backfill to ensure a minimum fines content corresponding to the design mix, the mix designed by STS Consultants had a fines content (P200) of 69.0 percent. This is indicated in the BFI communication included in Appendix D.

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The blending of the mixture was performed by a D6 Cat dozer in such a manner that the backfill became homogenous. Dry bentonite was added to the mixed backfill at a rate of two tons/200 trench feet. The backfill material just prior to placement had a consistency of wet concrete with a slump of four to six inches as determined by the method specified in ASTM C143-78. The blended backfill was sampled routinely and tested in the field to ensure that its total unit weight was at least 20 pcf heavier than that of the bentonite-water slurry.

The initial backfill was placed by the construction of a lead-in trench. The start of the lead-in trench extended 65 feet west of the start of the wall. Just prior to the backfilling operation, a cave-in of the trench top occurred. This allowed frozen material to be at the bottom of the key from station 0+00E to station 0+60E. The contractor opted to begin backfilling from the lead-in trench and return to re-excavate the wall and remove the frozen pieces at a later date. Backfilling was placed from the lead-in trench and placed such that its surface rose above the slurry level. This surface is known as "daylighting" of the backfill. The dozer filled the trench with the homogenous backfill from the daylight end. By filling at the daylight end the backfill material was allowed to slowly slide forward down the backfill slope displacing the bentonite-water slurry as it progressed.

By allowing the backfill to slide forward down the backfill slope, the cutoff wall shall be homogenous without voids. The toe of the backfill was 25 to 100 feet from the point of excavation. This allowed for the inspection of the trench bottom by both the contractor and the engineer.

During the extremely cold days of the last week of December, the top of the excavated material stockpiled on the sides became frozen. This was pushed to the side and the unfrozen material

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below was used in the backfill mixture. To make up for the unsuitable excavated material when waste was encountered and the discarded frozen soil, clay from Borrow Area No. 2 was used.

As the backfilling process continued and displacing of the bentonite-water slurry continued, a holding pond was required. The holding pond was constructed of clay and located in the area of the proposed secured cell No. 2. This bentonite-water slurry was assumed to be contaminated due to construction through the wastes, and the breaking of the pipe leading to the leachate storage tank. Temporary berms were constructed such that the bentonite-water slurry was diverted from the trench to the holding pond as the backfilling operation continued. The excess bentonite-water slurry was contained in the holding pond awaiting treatment by BFI.

3.4 Trench Re-excavation

Discuss

With the trenching of the cutoff wall completed at station 13+25S, the contractor mobilized the backhoe to the north end of the site. This mobilization was done to reconstruct the cutoff wall between stations 0+00E and 0+60E. Bentonite-water slurry transfer pipes were placed together and, as the trench depth reached six feet, the pumping commenced. During the excavation, a well-blended backfill material was being removed and piled on either side of the trench. At station 0+00E excavation was continued until the undisturbed native impervious strata was encountered. This signalled that the required key depth had been achieved.

After reaching the bottom of the key (station 0+00E), the contractor continued to dig the backfill out. Three large frozen pieces of backfill were removed. Re-excavation was continued to station 0+70E to insure that no other frozen material was left on the trench bottom. By the time the bottom of the trench at station 0+70E was re-excavated and cleaned, the

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previously placed backfill up to approximately station 1+70E had slumped into the excavation, forming a gentle slope. Backfilling was therefore done utilizing this "lean-in" trench. Dry bentonite and trench slurry were added to the excavated backfill and mixed well.

Backfill material was pushed into the trench by a D6 Cat dozer from the daylight end at approximately 1+80E moving westward. The excess slurry from the trench was allowed to empty into the secure cell No. 1 by the contractor cutting through the work pad. The backfilling process continued until the trench was completely filled.

3.5 Documentation

The site engineer present throughout the construction period documented the different phases of work. Photographs given in Appendix E show different phases of the project. Daily reports by the resident engineer can be found in Appendix F. The contractor provided the test report for the bentonite used and this is given in Appendix G.

3.6 Miscellaneous Items

3.6.1 Refuse Removal

The alignment of the slurry cutoff wall was to parallel the toe of slope from the codisposal site No. 1. The track of the backhoe was allowed to follow the toe. (The toe is defined as the intersection point where the construction pad meets the west slope of the codisposal cell No. 1). The centerline of the trench is ten feet west from the toe. At station 9+40S, refuse from the codisposal site was encountered. Thickness of waste ranging from 13 to 20 feet was encountered from station 9+40S to 13+25S with an average thickness of 17.0 feet. The waste was removed from the trench by the backhoe and loaded on scrapers,

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which hauled the refuse to the hazardous waste disposal area. During loading, some refuse was spilled onto the loading area. A rubber tire loader kept the area clear of debris until all of the trench was excavated.

The loading area needed to be free of waste, spillage, and any other debris due to the fact that this area was used for backfill mixing. BFI used a Cat⁹ 273 loader to remove a small layer of the loading area. By doing this, no refuse or spillage was left where backfill mixing was done. The Cat loader pushed all the spilled refuse and excavated material onto a pile such that it could be loaded. A Cat 225 backhoe loaded the scrapers which hauled the waste material to the active hazardous waste disposal area.

3.6.2 Leachate Line

A drain pipe which was to have extended 200 feet due north out of the leachate storage tank was hit. The line was not due north; therefore, during construction, the pipe was hit at approximately station 11+75S. According to BFI measurements, this would indicate that only the end of the line was removed. A loss of bentonite-water slurry from the trench was noted. During an investigation, the storage tank's liquid level was found to be equal to that of the trench slurry. This indicated that bentonite-water slurry loss was to the tank and not into the refuse.

3.7 Discussion of Testing and Summary of Results

3.7.1 Key Material Sampling and Testing

Samples of the key material were collected on a 100-foot interval to verify the adequacy of the strata into which the slurry wall was being keyed. These samples were delivered to and are kept at Foth & Van Dyke's soil laboratory. The soil lab

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classified the samples as a lean clay with little sand and gravel, dark gray (CL). See Table No. 3-1 Visual Classification of Key-In Material. No other testing was required other than the visual classification.

The cuttings from the key were examined by the site engineer continuously to be sure that the key was excavated in the impervious lean clay layer.

3.7.2 Slurry Sampling and Testing

Case International personnel performed quality assurance testing on the slurry. The Foth & Van Dyke site engineer performed quality assurance tests and also monitored the testing done by Case International personnel. The specified properties/requirements are given below:

- Bentonite content shall be a minimum of four percent by weight of water.
- Freshly mixed, fully hydrated, bentonite-water slurry must have a minimum viscosity of 40 marsh seconds.
- The bentonite-water slurry shall not lose more than 15 cm of fluid during the performance of the Standard Filter press test in accordance with API Specification RP13B at 100 psi applied for a 30-minute duration.
- Slurry introduced into the trench shall have a minimum density of not less than 63.5 pcf.

The trench slurry was sampled from the top of the trench as well as from the bottom. This sampling was done twice a day, mornings and afternoons. Samples from the holding pond were obtained four times a day or whenever the bentonite-water slurry was added to the trench or used for backfill mixing. See Table

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No. 3-2 for frequency of tests. Testing of the slurry from both the trench and the holding area is summarized in Table No. 3-3.

From all the testing in the field on the slurry and from reviewing Table Nos. 3-2 and 3-3, it was found that all test results satisfy the specifications.

3.7.3 Backfill Sampling and Testing

Quality assurance testing on backfill material was performed by both Case International and Foth & Van Dyke personnel. The Foth & Van Dyke site engineer monitored the tests done by Case International.

Backfill samples were obtained every 100 feet and tested for grain size and Atterberg limits at Foth & Van Dyke's soil laboratory. These samples were numbered GC-1 to GC-12. A spare sample of this backfill was also obtained. The lab data sheets are contained in Appendix H. Four Shelby tubes were pushed at an approximate spacing of 400 feet, along with a spare tube. These samples were numbered P1 to P4. From the Shelby tubes the dry density, moisture content, and coefficient of permeability were determined. The required coefficient of permeability was 1×10^{-7} cm/sec or less. The permeability test data are in Appendix I. The laboratory test results are summarized in Table No. 3-4.

Quality assurance of the backfill was also conducted daily in the field soil lab. The backfill was checked for slump per ASTM C143-79. A slump of four to six inches was specified to obtain a consistency of wet concrete. The fines content (P200) was also monitored daily. The minimum fines content was to be at least 69.0 percent.

TABLE NO. 3-2

Quality Assurance Tests on Bentonite-Water Slurry

Test	Location	Frequency	Remarks
Density	Slurry from holding tank	4 times/day min. or as required	Determine density whenever additional slurry is placed or when slurry is reconditioned.
Density	Slurry in trench close to its bottom	2 times/day	
Marsh Funnel Viscosity	Slurry from holding tank	4 times/day min. or as required	Determine viscosity whenever additional slurry is placed or when slurry is reconditioned.
Marsh Funnel Viscosity	Slurry in trench close to the surface	2 times/day	
Fluid Loss	Slurry from holding tank	2 times/day	
Fluid Loss	Slurry from trench close to the surface	2 times/day	

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TABLE NO. 3-3
Quality Assurance Tests in Field on Bentonite-Water Slurry
Winthrop Harbor Landfill

Test No.	Date	Location	Station	Viscosity (Seconds)	Density (lb./ft ³)	Volume of Filtrate (ML)	Temp. (° F)	Comments
1	12-18-88	Holding Pond		44	65.0	15.0	40	
2	12-18-88	Holding Pond		43	62.0	15.0	40	
3	12-18-88	Holding Pond		40	61.0	15.0	41	
4	12-18-88	Holding Pond		42	67.0	15.0	40	
5	12-18-88	Top of Trench	1+00E	44	65.5	15.0	40	
6	12-18-88	Top of Trench	0+00E	42	65.0	15.0	41	
7	12-18-88	Bottom of Trench	1+00E	43	64.0	15.0	40	
8	12-18-88	Bottom of Trench	0+00E	43	63.0	15.0	42	
9	12-19-88	Holding Pond		42	64.0	15.0	48	
10	12-19-88	Holding Pond		41	64.5	14.5	45	
11	12-19-88	Holding Pond		43	63.0	14.0	47	
12	12-19-88	Holding Pond		40	63.0	14.5	47	
13	12-19-88	Top of Trench	1+50E	41	65.5	14.0	48	
14	12-19-88	Top of Trench	1+96E	44	66.0	15.0	49	
15	12-17-88	Bottom of Trench	1+50E	42	65.0	15.0	48	
16	12-19-88	Bottom of Trench	1+96E	42	65.0	15.0	49	
17	12-21-88	Holding Pond		40	65.0	14.0	50	
18	12-21-88	Holding Pond		41	65.5	14.0	50	
19	12-21-88	Holding Pond		41	65.0	14.0	50	

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TABLE NO. 3-3 (Cont.)

Test No.	Date	Location	Station	Viscosity (Seconds)	Density (lb./ft ³)	Volume of Filtrate (ML)	Temp. (°F)	Comments
20	12-21-88	Holding Pond		40	64.5	14.5	50	
21	12-21-88	Top of Trench	2+50S	40	67.0	15.0	51	
22	12-21-88	Top of Trench	1+40E	40	66.0	14.0	57	
23	12-21-88	Bottom of Trench	2+50S	45	67.0	15.0	51	
24	12-21-88	Bottom of Trench	1+40E	40	65.0	14.5	51	
25	12-22-88	Top of Trench	3+50S	49	68.0	14.0	46	
26	12-22-88	Top of Trench	2+50S	46	67.0	14.5	46	
27	12-22-88	Bottom of Trench	3+50S	53	70.0	14.5	49	
28	12-22-88	Bottom of Trench	2+50S	51	69.0	14.5	49	
29	12-23-88	Bottom of Trench	1+90E	47	69.5	14.5	43	
30	12-23-88	Bottom of Trench	4+00S	46	68.0	15.0	44	
31	12-23-88	Top of Trench	1+90E	42	66.0	14.0	40	
32	12-23-88	Top of Trench	4+00S	44	66.0	15.0	41	
33	12-27-88	Bottom of Trench	4+00S	48	69.0	14.5	41	
34	12-27-88	Bottom of Trench	4+50S	48	69.5	14.0	41	
35	12-27-88	Top of Trench	2+50S	52	72.0	14.5	41	
36	12-27-88	Top of Trench	5+50S	48	73.0	14.5	41	
37	12-28-88	Holding Pond		42	65.5	14.5	38	
38	12-28-88	Holding Pond		56	65.0	13.5	38	
39	12-28-88	Holding Pond		51	66.0	14.0	39	

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TABLE NO. 3-3 (Cont.)

Test No.	Date	Location	Station	Viscosity (Seconds)	Density (lb./ft ³)	Volume of Filtrate (ML)	Temp. (° F)	Comments
40	12-28-88	Holding Pond		41	65.0	14.5	41	
41	12-28-88	Top of Trench	5+80S	52	74.0	15.0	38	
42	12-28-88	Top of Trench	6+30S	50	71.5	15.0	43	
43	12-28-88	Bottom of Trench	5+80S	48	72.0	15.0	40	
44	12-28-88	Bottom of Trench	6+00S	47	70.0	14.5	40	
45	12-29-88	Bottom of Trench	7+50S	59	65.0	13.0	40	
46	12-29-88	Bottom of Trench	7+60S	54	67.0	14.5	40	
47	12-29-88	Top of Trench	7+50S	53	61.0	14.0	40	
48	12-29-88	Top of Trench	7+60S	53	60.0	14.0	40	
49	12-30-88	Holding Pond		53	65.0	14.0	43	
50	12-30-88	Holding Pond		54	64.0	14.0	40	
51	12-30-88	Holding Pond		41	65.5	15.0	45	
52	12-30-88	Holding Pond		41	66.0	15.0	47	
53	12-30-88	Bottom of Trench	7+60S	59	65.0	14.5	38	
54	12-30-88	Bottom of Trench	7+50S	54	67.0	13.0	37	
55	12-30-88	Top of Trench	8+50S	50	68.0	14.5	47	
56	12-30-88	Top of Trench	7+50S	48	60.0	15.0	45	
57	12-31-88	Bottom of Trench	8+60S	50	72.5	14.0	40	
58	12-31-88	Bottom of Trench	8+80S	53	70.0	14.5	40	
59	12-31-88	Top of Trench	8+00S	50	68.5	14.5	40	

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TABLE NO. 3-3 (Cont.)

Test No.	Date	Location	Station	Viscosity (Seconds)	Density (lb./ft ³)	Volume of Filtrate (ML)	Temp. (°F)	Comments
60	12-31-88	Top of Trench	7+00S	50	67.0	15.0	40	
61	1-1-89	Holding Pond		44	68.0	12.5	39	
62	1-1-89	Holding Pond		42	67.5	13.0	37	
63	1-1-89	Holding Pond		42	66.5	13.0	37	
64	1-1-89	Holding Pond		42	66.5	13.0	37	
65	1-1-89	Bottom of Trench	8+50S	58	70.0	13.5	37	
66	1-1-89	Bottom of Trench	9+50S	65	72.5	13.5	36	
67	1-1-89	Top of Trench	10+20S	53	73.0	13.5	43	
68	1-1-89	Top of Trench	10+00S	51	72.5	12.5	40	
69	1-2-89	Top of Trench	11+00S	53	72.0	13.0	43	
70	1-2-89	Top of Trench	11+50S	55	70.0	13.5	43	
71	1-2-89	Bottom of Trench	10+60S	54	73.5	13.5	39	
72	1-2-89	Bottom of Trench	10+40S	51	72.5	13.5	39	
73	1-3-89	Holding Pond		42	66.0	14.0	37	
74	1-3-89	Holding Pond		43	66.5	14.0	37	
75	1-3-89	Holding Pond		43	69.0	14.5	39	
76	1-3-89	Holding Pond		41	69.0	15.0	39	
77	1-3-89	Top of Trench	11+00S	49	70.0	13.5	38	
78	1-3-89	Top of Trench	12+00S	50	68.0	14.0	38	
79	1-3-89	Bottom of Trench	11+00S	51	74.0	14.0	43	

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TABLE NO. 3-3 (Cont.)

Test No.	Date	Location	Station	Viscosity (Seconds)	Density (lb./ft ³)	Volume of Filtrate (ML)	Temp. (° F)	Comments
80	1-3-89	Bottom of Trench	12+00S	47	70.0	14.0	43	
81	1-4-89	Holding Pond		40	66.0	15.0	38	
82	1-4-89	Holding Pond		41	64.0	15.0	38	
83	1-4-89	Holding Pond		40	65.0	15.0	37	
84	1-4-89	Holding Pond		40	72.0	15.0	39	
85	1-4-89	Top of Trench	13+00S	50	70.0	15.0	39	
86	1-4-89	Top of Trench	12+50S	53	70.0	15.0	40	
87	1-4-89	Bottom of Trench	13+00S	47	73.0	14.5	40	
88	1-4-89	Bottom of Trench	12+50S	49	72.0	14.5	40	

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TABLE NO. 3-4

Summary of Laboratory Soil Testing
Results for Backfill Material

Sample No.	Station No.	P-200 (%)	Clay (%) Content	LL	PL	PI
GC-1	1+00E	79.4	33.1	30.3	14.6	15.7
GC-2	1+96E	76.2	27.5	31.0	14.6	16.4
GC-3	3+00S	76.4	29.5	31.7	15.4	16.3
GC-4	4+00S	78.3	30.0	31.4	15.4	16.0
GC-5	5+00S	79.1	31.5	33.0	15.6	17.4
GC-6	6+00S	75.1	29.5	32.6	14.8	17.8
GC-7	7+00S	76.8	30.0	33.1	14.5	18.6
GC-8	8+00S	78.8	29.8	32.2	14.5	17.7
GC-9	9+00S	78.2	31.0	30.5	14.4	16.1
GC-10	10+00S	73.7	31.0	35.2	15.0	20.2
GC-11	11+00S	76.1	32.5	36.0	14.9	21.1
GC-12	12+00S	77.3	32.5	36.3	14.8	21.5

Summary of Permeability Test Results on Backfill

Sample No.	Station No.	Moisture Content (%)	Dry Density (lb/ft ³)	Permeability (cm/sec)
P-1	1+00 E	23.6	105.8	3.5×10^{-8}
Spare	1+00 E	21.0	108.1	-
P-2	3+00 S	17.4	114.6	2.8×10^{-8}
P-3	7+00 S	19.6	113.7	1.1×10^{-8}
P-4	11+00 S	28.0	98.0	3.3×10^{-8}

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The blended backfill had a sufficient plasticity to allow a rolling of 1/8" thread in accordance with procedures in ASTM D4318.

Backfill surface profile measurement within the trench was conducted routinely to verify the slope of backfill being placed into the trench. This was done by measuring the depth to the backfill surface along the construction pad at various intervals. The slope of backfill was found to vary from 6H:1V to 10H:1V.

The mixed backfill was routinely tested to ensure that the total unit weight was at least 20 pcf heavier than the bentonite-water slurry density at the bottom of the trench. This difference in density made sure the bentonite-water slurry was being displaced during backfilling. Tests completed in the field during backfilling are summarized in Table No. 3-5.

TABLE NO. 3-5

Quality Assurance In-Field Testing of Trench Backfill

Winthrop Harbor Landfill

Date	Location	Slump (Inches)	Wet Density (lb/ft. ³)	Temp. (°F)	<#200 (%)
12-21-88	0+00E	4	120.0	40	77.3
12-22-88	1+00E	4	117.0	40	76.2
12-23-88	1+00E	5	120.0	43	75.3
12-27-88	1+96E	4.5	117.0	43	76.4
12-28-88	3+50S	5	112.5	40	72.8
12-29-88	3+00S	4	119.0	43	75.2
12-29-88	3+50S	6	120.5	41	73.1
12-30-88	3+00S	6	116.0	41	75.5
12-30-88	4+00S	5	120.0	43	86.6
12-31-88	4+00S	5	119.0	40	75.6
1-1-89	4+00S	5	119.5	42	76.7
1-1-89	4+50S	6	121.0	41	73.8
1-2-89	5+00S	5.5	118.5	42	78.1
1-2-89	6+00S	6	120.0	40	76.1
1-2-89	7+00S	5	120.0	40	76.1
1-3-89	8+00S	6	120.0	38	73.9
1-4-89	9+00S	6	119.0	40	71.6
1-5-89	10+00S	<u>6</u>	<u>120.0</u>	<u>41</u>	<u>72.4</u>
	Averages	5	118.8	41	75.5

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4.0 REMAINING CONSTRUCTION ACTIVITIES

With the completion of the cutoff wall, a number of items need some attention.

4.1 Site Cleanup

Any debris, excavated wastes, or spills resulting from the construction of the slurry wall must be properly disposed of and the affected locations adequately cleaned. One of the sites in this regard is the temporary holding pond which was built to collect the contaminated bentonite-water slurry.

The fresh slurry pond which the contractor used to store the fresh bentonite-water slurry must be filled and the drainage of the site re-established to its preconstruction state.

4.2 Pad Removal and Capping

The part of the construction pad which was not used for backfill mixing must be removed and site drainage restored to its original condition. The area must be cut enough such that a protective layer of soil (cap) can be placed over the constructed cutoff wall to prevent it from desiccation and erosion and to provide for an adequate foundation for construction equipment traffic.

4.3 Extend Monitor Well No. ^{G136}~~111~~

After final grading and capping of the cutoff wall, monitoring well No. ~~111~~ must be extended and access for sampling provided.

G136

DRAFT**5.0 CONCLUSIONS**

Based upon our observations, surveys, photographs, record drawings, and soil laboratory results, it is our opinion that the slurry cutoff wall construction at the Winthrop Harbor Waste Management Facility has been constructed in substantial compliance with the design.

Appendix A

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**Subsurface Exploration and Slurry Trench
Backfill Mix Design**

**BFI Landfill
Winthrop Harbor, Illinois**

Case International Company



STS Consultants Ltd.
Consulting Engineers

111 Pfingsten Road
Northbrook, Illinois 60062
(312) 272-6520

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January 18, 1989

Mr. Robert Martin
Case International Company
PO Box 40
1325 W. Lake Street
Roselle, IL 60172

**RE: Subsurface Exploration and Slurry Trench Backfill Mix Design for the Proposed
Slurry Cutoff Wall to be Constructed at the BFI Landfill Site in Winthrop Harbor,
Illinois -- STS Project No. 17590-XH**

Dear Mr. Martin:

We have completed the subsurface exploration and laboratory testing for the slurry trench backfill mix design to be utilized for the construction of the proposed slurry cutoff wall at the BFI landfill site in Winthrop Harbor, Illinois in general conformance with our letter dated October 18, 1988.

This report presents the results of our field and laboratory testing programs and provides our recommendations for the slurry trench backfill mix design.

If there are any questions with regard to the information contained in this report, or if we may be of further service to you, please do not hesitate to contact us.

Respectfully,

STS CONSULTANTS, LTD.

Maria G. Flessas

Maria G. Flessas
Assistant Project Engineer

Safdar A. Gill
Safdar A. Gill, Ph.D., P.E.
Senior Principal Engineer

cc: Mr. Tim Ambrosius
Foth & VanDyke
2737 S. Ridge Rd.
PO Box 19012
Green Bay, WI 54307-9012

MGF/nt
enc.

Report

DRAFT**Project**

SUBSURFACE EXPLORATION AND
SLURRY TRENCH BACKFILL MIX DESIGN
FOR THE PROPOSED SLURRY CUTOFF WALL
BFI LANDFILL SITE
WINTHROP HARBOR, ILLINOIS

Client

CASE INTERNATIONAL COMPANY
PO BOX 40
1325 W. LAKE STREET
ROSELLE, IL 60172

Project #17590-XH

DateJANUARY 18, 1989



STS Consultants Ltd.
Consulting Engineers

111 Pfingsten Road
Northbrook, Illinois 60062
(312) 272-6520

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Introduction

A slurry cutoff wall is proposed to be constructed in the Browning Ferris Industries (BFI) landfill site, in Winthrop Harbor, Illinois. The proposed slurry wall alignment is planned to separate the existing codisposal unit from the future secure cells, and cutoff sand zones along the south and southeast sections of the codisposal unit. The perimeter cutoff wall is estimated to be about 2,595 feet in length. Anticipated depth of excavation for the slurry trench will average about 32 feet and range from 20 to 37 feet.

Scope of Work

STS Consultants, Ltd. selected seven boring locations for obtaining soil samples along the proposed alignment of the cutoff wall. The locations of the borings were selected based upon soil information provided to us by Case International Company, with the intent to sample within areas of the cutoff wall where permeable zones of soils will be encountered during excavation. A location diagram showing the borings is attached. These borings were extended to the base of the proposed slurry cutoff wall.

Soil samples obtained from the boring locations were brought to our laboratory in Northbrook, Illinois for further examination and testing. Soil conditions encountered at the individual boring locations are described on the attached boring logs. Stratification lines on the boring logs which separate the various layers are estimated; in-situ, the transition between soil types may be gradual.

Both sieve and hydrometer grain size tests were performed on combined soil samples obtained from each boring location to determine the average grain size distribution of the combined samples tested. Sieve and hydrometer grain size tests were also performed on representative samples from two areas on the site where material could be borrowed

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January 18, 1989

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for the construction of the slurry cutoff wall, designated as borrow pit No. 1 and No. 2 on the attached boring location diagram.

A total of six hydraulic conductivity tests were performed to determine the permeability of the proposed trench backfill mix and to estimate the amount of borrow material needed for the most unfavorable soil conditions where sandy soil zones were encountered. One hydraulic conductivity test was performed on a composite sample obtained from the stratum of gray silty clay into which the bottom of the proposed cutoff wall will be keyed.

A sieve and hydrometer grain size test was also performed on the proposed trench backfill mix.

The procedures for the tests performed, sample mixing and preparation are detailed in the following sections. Results of all tests performed are included in the Appendix of this report.

Sample Preparation

Based upon the estimated thickness of different soil strata at each boring location, and the estimated average wet unit weight of the soil in each stratum, a weighted average soil sample was prepared for each boring. The proportions of materials taken from each stratum were based on the thickness of that stratum. The following types of samples were prepared for testing.

1. Composite remolded samples, compacted to represent in-situ density.
2. Composite samples with addition of bentonite slurry to obtain a 4 to 6 inch slump.

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The second type were composed of (a) entirely the materials recovered from soil borings, (b) materials from soil borings plus borrow materials, and (c) materials plus dry bentonite.

Boring B-4 was assumed to represent the most unfavorable soil conditions i.e. it had the largest amount of sand and silt zones. Boring B-1 was assumed to be representative of the most favorable soil conditions as it had the least sand zones. Hence, composite samples from these borings were used for the initial tests. The following samples were prepared for the tests.

1. A combined sample from B-4.
2. A combined sample from B-4 with 4% bentonite slurry.
3. A combined sample from B-1 with the addition of 4% slurry.
4. A composite sample of the gray silty clay soil from B-1, B-3, B-5 and B-7. The proposed slurry cutoff wall will be keyed into this stratum.

The second series of tests was performed on composite samples from borings B-3 and B-4 (most unfavorable soil conditions), with different amounts of borrow materials, dry bentonite, and bentonite slurry to obtain a 4 to 6 inch slump. Specimens in the second test series were consolidated with 3 psi consolidation pressure.

Hydraulic Conductivity Testing Procedures and Apparatus

Hydraulic Conductivity Specimen Preparation

The bentonite slurry was prepared by mixing 4% by weight of bentonite to water. Bentonite was mixed with deionized water using a high speed mixer and then allowed to hydrate for a 24 hour period. This slurry was then added to the combined soil specimen and was mixed together to provide a 4 to 6 inch slump.

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Specimens containing borrow materials and bentonite were formulated by adding 1% bentonite by total dry weight to the combined sample material. Ten to 20% of borrow material was added to the combined sample to evaluate the amount of such borrow needed to obtain the desired permeability. The materials were mixed together and then the 4% slurry was added to provide a 4 to 6 inch slump. The material, after all the components were added was thoroughly mixed creating a homogeneous material.

Immediately following the mixing procedure, specimens were molded into a cylindrical shape by being placed into a rubber membrane stretched over a triaxial split mold. The material was poured into the mold and rodded to obtain a homogeneous specimen, free of any visible air voids. Surrounding both the specimen and the rubber membrane was a solid cylindrical plastic mold to aid in maintaining the shape and continuity of the test specimen throughout the test. The specimen was then sealed into a triaxial chamber and the back pressure saturation procedures began.

Test Apparatus

The test apparatus used for the hydraulic conductivity determination was a triaxial compression permeameter. This type of apparatus is exceptionally well suited for hydraulic conductivity testing when relatively low hydraulic conductivity values are anticipated. The equipment supports the use of a flexible rubber membrane which surrounds the test specimen providing a seal around the specimen sides, backpressure to facilitate specimen saturation and small capillary burettes which enable the measurement of small volumes of collected permeant. The equipment also provides a sealed environment for the test specimen and for the permeant which prevents evaporation of permeant and inaccuracy of readings in long term testing.

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Testing Procedures

Following the placement of the specimen in the triaxial chamber, the back pressure saturation procedure was initiated. This procedure provides for the cell pressure (confining pressure) and backpressure (saturating pressure) to be simultaneously increased in increments of 0.5 kilograms per square centimeter (ksc), while maintaining a slight pressure differential throughout the test on the order of 0.15 ksc with the cell pressure the higher of the two. The pressures were increased periodically until testing pressures of 4.2 ksc cell pressure and 4.0 ksc backpressure was obtained. Each specimen was allowed to remain its saturation phase with both cell and backpressures acting upon it for an approximately period of 24 hours. To determine the degree of specimen saturation Skempton's pore pressure B parameter was determined. This "B" parameter is simply a ratio of an increase in pore water pressure to a corresponding and simultaneous increase in confining pressure. A "B" parameter of 0.95 or greater considers the specimen to be fully saturated.

Following full specimen saturation, the permeant flow was initiated to the bottom of the specimen. The collected permeant, exiting from the top of the specimen was channeled into a calibrated burette. During the entire test, permeant volume versus time measurements were recorded and the hydraulic conductivity of the test specimen was determined. The test was terminated when stabilized flow had been established. A summary of test data for the various samples tested is attached.

Grain Size Analysis Determination

Combined sieve/hydrometer analysis were performed in accordance with ASTM D-422. The grain size distribution curves obtained for all tests performed are included in the Appendix of this report.

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Laboratory Test Results

Based upon the hydraulic conductivity tests performed, we recommend that the bentonite slurry used during trench excavation should contain a minimum of 4% by weight of bentonite to water. To obtain a permeability of 5×10^{-7} centimeters per second for the backfill, the mixture should contain a minimum of 20% of the borrow material from area denoted Borrow Pit Area 2. In addition, a 1% dry bentonite by total weight should be added to the mix material. The remaining backfill may consist of suitable excavated material. Before placement in the trench, the selected backfill materials must be thoroughly mixed to obtain a slump of 4 to 6 inches. Placement procedures should be according to the specifications and accepted practice to avoid trapping of pockets of slurry. Any settled cuttings must be removed from the base of the trench. If any organic soils are encountered in the trench excavation, these should be discarded.

Based upon our laboratory test results, the proposed mixture should give a hydraulic conductivity of 5×10^{-7} centimeters per second.

Report



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Appendix

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APPENDIX

1. General Qualifications
 2. Changed Conditions Clause
 3. Location Diagram
 4. Boring Logs
-

STS General Qualifications

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This report has been prepared in order to aid in the evaluation of this property and to assist the architect and/or engineer in the design of this project. The scope is limited to the specific project and location described herein, and our description of the project represents our understanding of the significant aspects relevant to soil and foundation characteristics. In the event that any changes in the design or location of the structure(s) as outlined in this report are planned, we should be informed so the changes can be reviewed and the conclusions of this report modified as necessary in writing by the soil and foundation engineer. As a check, we recommend that we be authorized to review the project plans and specifications to confirm that the recommendations contained in this report have been interpreted in accordance with our intent. Without this review, we will not be responsible for misinterpretation of our data, our analysis, and/or our recommendations, nor how these are incorporated into the final design.

It is recommended that all construction operations dealing with earthwork and foundations be reviewed by an experienced soil engineer to provide information on which to base a decision whether the design requirements are fulfilled in the actual construction. If you wish, we would welcome the opportunity to provide field construction services for you during construction.

The analysis and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated on the location diagram and from any other information discussed in this report. This report does not reflect any variations which may occur between these borings. In the performance of subsurface explorations, specific information is obtained at specific locations at specific times. However, it is a well-known fact that variations in soil and rock conditions exist on most sites between boring locations and also such situations as groundwater levels vary from time to time. The nature and extent of variations may not become evident until the course of construction. If variations then appear evident, it will be necessary for a re-evaluation of the recommendations of this report after performing on-site observations during the construction period and noting the characteristics of any variations.

Because of the possibility of these unanticipated subsurface conditions occurring, we recommend that a "changed conditions" clause be provided in the contract both with the general contractor and in contracts with sub-contractors involved in the foundation and earthwork construction. It is felt that the inclusion of this clause will permit contractors to give lower prices because they will not need to provide as much in contingencies as they normally would if equitable adjustment of changed conditions will minimize conflicts and litigation with the attendant delays and costs. Furthermore, by the immediate recognition and adjustment in contract price at the time any changed conditions are encountered, the immense problem of trying to recreate facts when litigation develops later is eliminated. A mediation/arbitration procedure is recommended in the event that the owner, contractor and professionals do not agree on the changed conditions at the moment they are disclosed. If you wish, we would be pleased to furnish additional information pertaining to this procedure. A suggested wording is given on a separate sheet entitled: "Changed Conditions Clause".

STS Changed Conditions Clause



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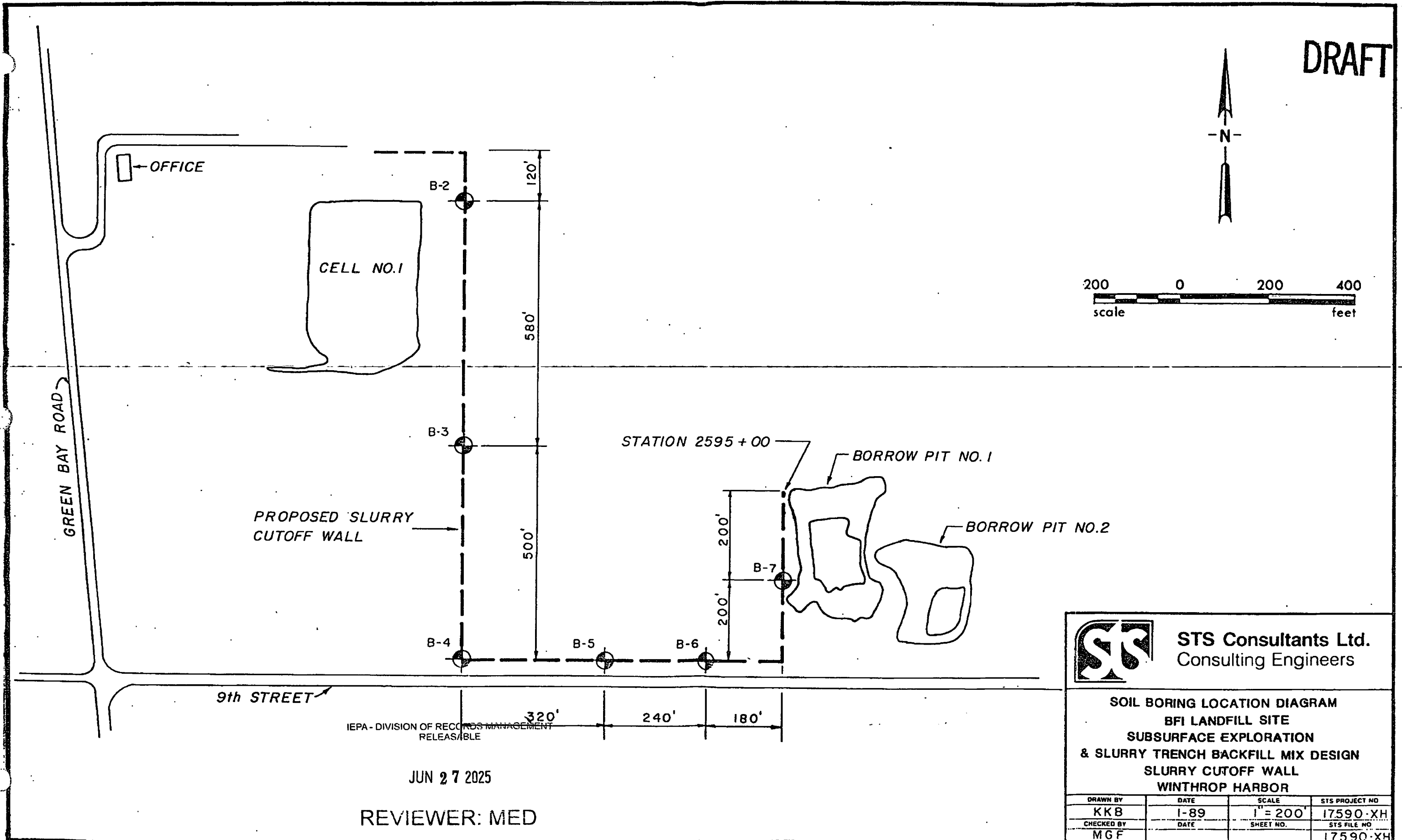
The following is a suggested standard clause for unanticipated subsurface conditions:

"The owner has had a subsurface exploration performed by a foundation consultant, the results of which are contained in the consultant's report. The consultant's report presents his conclusions on the subsurface conditions based on his interpretation of the data obtained in the exploration. The contractor acknowledges that he has reviewed the consultant's report and any addenda thereto, and that his bid for earthwork operations is based on the subsurface conditions, as described in that report. It is recognized that a subsurface exploration may not disclose all conditions as they actually exist and further, conditions may change, particularly groundwater conditions, between the time of subsurface exploration and the time of earthwork operations. In recognition of these facts, this clause is entered in the contract to provide a means of equitable additional compensation for the contractor if adverse unanticipated conditions are encountered and to provide a means of rebate to the owner if the conditions are more favorable than anticipated.

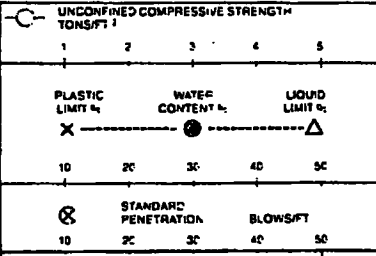
At any time during earthwork, paving and foundation construction operations that the contractor encounters conditions that are different than those anticipated by the foundation consultant's report, he shall immediately (within 24 hours) bring this fact to the owner's attention. If the owner's representative on the construction site observes subsurface conditions which are different than those anticipated by the foundation consultant's report, he shall immediately (within 24 hours) bring this fact to the contractor's attention. Once a fact of unanticipated conditions has been brought to the attention of either the owner or the contractor, and the consultant has concurred, immediate negotiations will be undertaken between the owner and the contractor to arrive at a change in contract price for additional work or reduction in work because of the unanticipated conditions. The contractor agrees that the following unit prices would apply for additional or reduced work under the contract. For changed conditions for which unit prices are not provided, the additional work shall be paid for on a time and material basis."

Another example of a changed conditions clause can be found in paper No. 4035 by Robert F. Borg, published in ASCE Construction Division Journal, No. C02, September 1964, page 37.

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		OWNER BFI		LOG OF BORING NUMBER B-1	
		PROJECT NAME Slurry Trench Backfill Mix Design For Slurry Cutoff Wall		ARCHITECT-ENGINEER	
DRAFT					
SITE LOCATION Winthrop Harbor					
DEPTH (FT) ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT LBS./FT. ³
5.0	1	SS		Silty clay fill, trace sand, topsoil & wood - (CL-Fill)	
10.0	2	SS		Silty clay, trace gravel & sand - brown - (CL)	
15.0	3	SS		Silty clay, trace gravel & sand - gray - (CL)	
20.0	4	SS		Silt - brown - moist to wet - (ML)	
25.0	5	SS		Fine to medium sand, trace silt - brown - saturated - (SP)	
30.0	6	SS		Silty clay, trace sand - gray - (CL)	
35.0	7	SS			
40.0				END OF BORING	
41.0				Borehole backfilled upon completion.	
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU. THE TRANSITION MAY BE GRADUAL.					
WL 15.0'	WS 15.0'	BORING STARTED 10/17/88		STS OFFICE Northbrook-01	
WL BCR	ACR	BORING COMPLETED 10/17/88		DRAWN BY KKB	SHEET NO 1 OF 1
WL AB		RIG FOREMAN		APP'D BY MGF/pk	STS JOB NO. 17590-XH

 STS Consultants Ltd.		OWNER BFI		LOG OF BORING NUMBER B-2	
		PROJECT NAME Slurry Trench Backfill Mix Design For Slurry Cutoff Wall		ARCHITECT-ENGINEER	
DRAFT					
SITE LOCATION Winthrop Harbor					
DESCRIPTION OF MATERIAL					
DEPTH (FT) ELEVATION (FT)	SAMPLE NO	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	UNIT DRY WT. LBS/FT³	
1	GS	SURFACE ELEVATION			
5.0		Silty clay fill, trace gravel & sand - brown - (CL-Fill)			
2	GS				
10.0		Silty clay - brown - (CL)			
3	GS				
15.0		Sandy silt - wet - (SM)			
4	GS				
5	GS	Silty clay, trace sand - gray - (CL)			
6	GS				
20.0		END OF BORING Borehole grouted upon completion.			
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU. THE TRANSITION MAY BE GRADUAL					
WL 17.5'		WS OR WD		BORING STARTED	
				10-19-88	
WL		BCR	ACR	BORING COMPLETED	
				10-19-88	
WL		RIG FOREMAN		APP'D BY	
AB		DR-77/Dumas		MGF/pk	
				STS OFFICE	
				Northbrook-01	
				DRAWN BY	
				KKB	
				SHEET NO. 1 OF 1	
				STS JOB NO	
				17590-XH	

DRAFT

APPENDIX A

Design Report by STS Consultants

		OWNER BFI		LOG OF BORING NUMBER B-3	
		PROJECT NAME Slurry Trench Backfill Mix Design For Slurry Cutoff Wall		ARCHITECT-ENGINEER	
DRAFT					
SITE LOCATION Winthrop Harbor					
DEPTH (FT) ELEVATION (FT)	SAMPLE NO. SAMPLE TYPE SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL		UNCONFINED COMPRESSIVE STRENGTH TONS/FT ²	
				PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % X ● ▲ 10 20 30 40 50	
SURFACE ELEVATION		UNIT DRY WT. LBS/FT ³		STANDARD PENETRATION BLOWS/FT 10 20 30 40 50	
1	GS	Silty clay fill, trace sand - brown - (CL-Fill)			
2	GS	Silty clay, trace gravel & sand - brown & gray - (CL)			
3	PA	Sandy clay, trace gravel - brown & gray - (CL)			
4	GS	Silty clay - gray - (CL)			
5	GS	Silty fine to medium sand - gray - saturated - (SM)			
6	GS	Silty clay with sand seams, trace gravel - gray - (CL)			
END OF BORING		Borehole grouted upon completion.			
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU. THE TRANSITION MAY BE GRADUAL					
WL 14.5'	WS OR WD	BORING STARTED 10-19-88		STS OFFICE Northbrook-01	
WL	BCR ACR	BORING COMPLETED 10-19-88		DRAWN BY KKB	SHEET NO. 1 OF 1
WL	AB	RIG FOREMAN DR-77/Dumas		APP'D BY MGF/pk	STS JOB NO. 17590-XH

 STS Consultants Ltd.		OWNER BFI		LOG OF BORING NUMBER B-4	
		PROJECT NAME Slurry Trench Backfill Mix Design For Slurry Cutoff Wall		ARCHITECT-ENGINEER	
DRAFT					
SITE LOCATION Winthrop Harbor					
DEPTH (FT) ELEVATION (FT)	SAMPLE NO. SAMPLE TYPE SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL		UNCONFINED COMPRESSIVE STRENGTH TONS/FT ²	
				PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT %	
SURFACE ELEVATION		STANDARD PENETRATION BLOWS/FT		UNIT DRY WT. LBS/FT ³	
1	GS	Silty clay fill, little topsoil, trace gravel & sand - brown - (CL-Fill)		10	20
2	GS	Silty clay, trace gravel & sand - brown & gray - (CL)		10	20
3	GS	Clayey silt, trace sand - light brown - (CL-ML)		10	20
4	GS	Clayey sand, trace gravel - brown - wet - (SC)		10	20
5	GS	Silty & sandy clay, trace gravel - brown - (CL)		10	20
6	GS	Silty clay, trace gravel & sand - gray - (CL)		10	20
END OF BORING Borehole grouted upon completion.					
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU. THE TRANSITION MAY BE GRADUAL					
WL 9.5'		WS OR WD		BORING STARTED 10-19-88	
WL BCR		ACR		BORING COMPLETED 10-19-88	
WL AB		RIG FOREMAN DR-77/Dumas		STS OFFICE Northbrook-1	
				DRAWN BY KKB	
				SHEET NO. 1 OF 1	
				APP'D BY MGF/pk	
				STS JOB NO. 17590-XH	



STS Consultants Ltd.

OWNER

BFI

 PROJECT NAME
 Slurry Trench Backfill Mix Design For
 Slurry Cutoff Wall

LOG OF BORING NUMBER

B-5

ARCHITECT-ENGINEER

DRAFT

SITE LOCATION

Winthrop Harbor

DEPTH (FT) ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT LB/FT ³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT ²	PLASTIC LIMIT %	WATER CONTENT %	LIQUID LIMIT %	STANDARD PENETRATION	BLOWS/FT
1	GS										
5.0											
2	GS										
10.0											
	GS			Silty clay fill, little topsoil, trace gravel, sand & topsoil - brown & black - (CL-Fill)							
	GS			Sandy clay, trace gravel - brown - (SC-CL)							
	GS			Silty clay, little to trace sand - brown - (CL)							
	GS			Clayey sand, trace gravel - (SC)							
				Silty clay, trace gravel & sand - brown - (CL)							
	GS			Sandy silt - brown - (ML)							
	GS			Silty clay, trace gravel & sand - gray - (CL)							
	GS										
				END OF BORING							
				Borehole grouted upon completion.							

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU. THE TRANSITION MAY BE GRADUAL.

WL	WS OR WD	BORING STARTED	STS OFFICE
7.0'		10/20/88	Northbrook-01
WL	BCR	ACR	DRAWN BY
			KKB
		BORING COMPLETED	SHEET NO. OF
		10/20/88	1 1
WL	AB	RIG FOREMAN	APP'D BY
		DR-77/Dumas	MGF/pk
			STS JOB NO
			17590-XH

BL-3-0687

 STS Consultants Ltd.		OWNER BFI		LOG OF BORING NUMBER B-6	
		PROJECT NAME Slurry Trench Backfill Mix Design For Slurry Cutoff Wall		ARCHITECT-ENGINEER	
DRAFT					
SITE LOCATION Winthrop Harbor					
DEPTH (FT)	ELEVATION (FT)	SAMPLE NO	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL
					UNIT DRY WT. LBS/FT ³
SURFACE ELEVATION					UNCONFINED COMPRESSIVE STRENGTH TONS/FT ² 1 2 3 4 5 PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % X ————— ● ————— Δ 10 20 30 40 50 STANDARD PENETRATION BLOWS/FT 10 20 30 40 50
1	5.0	GS			Silty clay fill, trace gravel & sand - brown - (CL-Fill)
2		GS			Silty clay, trace gravel & sand - gray - (CL)
3	10.0	GS			Clayey sand, trace gravel - brown - (SC)
		GS			Silty clay, trace gravel & sand - gray - (CL)
4		GS			
5		GS			Cinder Fill
6	20.0	GS			Silty clay, trace gravel & sand - gray - (CL)
		GS			
7	30.0	GS			Silty clay, sand & gravel - (CL & SM - GM)
8		GS			Silty clay, trace gravel & sand - gray - (CL)
					END OF BORING Borehole grouted upon completion
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU. THE TRANSITION MAY BE GRADUAL.					
WL 17.0'		WS OR WD	BORING STARTED 10/20/88		STS OFFICE Northbrook-01
WL BCR		ACR	BORING COMPLETED 10/20/88		DRAWN BY KKB
WL AB			RIG FOREMAN DR-77/Dumas		APP'D BY MGF/pk
					SHEET NO. 1 OF 1
					STS JOB NO. 17590XH



STS Consultants Ltd.

OWNER

BFI

PROJECT NAME

Slurry Trench Backfill Mix Design For
Slurry Cutoff Wall

LOG OF BORING NUMBER

B-7

ARCHITECT-ENGINEER

DRAFT

SITE LOCATION

Winthrop Harbor

DEPTH (FT) ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. ³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. ²			PLASTIC LIMIT % X	WATER CONTENT % ●	LIQUID LIMIT % △
							1	2	3			
					SURFACE ELEVATION							
1	GS				Silty clay, trace clay & gravel - brown - (CL-Fill)							
5.0												
	GS											
10.0	2	GS			Topsoil - black - (OL)							
3	GS				Silty clay - brown - (CL)							
15.0												
	GS											
4	GS				Silty clay, trace gravel & sand - gray - (CL)							
20.0												
					END OF BORING							
					Borehole grouted upon completion.							

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU. THE TRANSITION MAY BE GRADUAL.

WL	WS OR WD	BORING STARTED	STS OFFICE
Dry		10-19-88	Northbrook-01
WL	BCR	ACR	DRAWN BY
		10-19-88	KKB
WL	RIG FOREMAN	APP'D BY	STS JOB NO
AR	DR-77/Dumas	MGF/pk	17590-XH

STS CONSULTANTS, LTD.

DRAFT

GRAIN SIZE DISTRIBUTION (ASTM D 422)

Project : BFI
 Boring/Source: WINTHROP HARBOR
 Sample Number: 1-COMBINED
 Depth (feet): -
 USCS Classification: (CL)
 Soil Description : SILTY CLAY, LITTLE F TO C SAND-BROWNISH GRAY

STS Job No.: 17590-XF
 Date : 11-07-88
 LL: - PL: - PI: -
 WC: - SP.GR.: 2.73 Est.

SIEVE ANALYSIS --

SAMPLE WEIGHT: 67.99 GRAMS

SIEVE SIZE	WEIGHT RETAINED	PER CENT RETAINED	PER CENT PASSING
1"	0.00	0.00	100.00
.75"	0.00	0.00	100.00
.50"	0.00	0.00	100.00
.375"	0.00	0.00	100.00
#4	0.32	0.47	99.53
#10	0.42	0.62	98.91
#20	1.01	1.49	97.43
#40	1.65	2.43	95.00
#60	2.56	3.77	91.23
#100	2.90	4.27	86.97
#200	2.57	3.78	83.19

HYDROMETER ANALYSIS --

HYDROMETER SAMPLE WEIGHT: 51.35 GRAMS

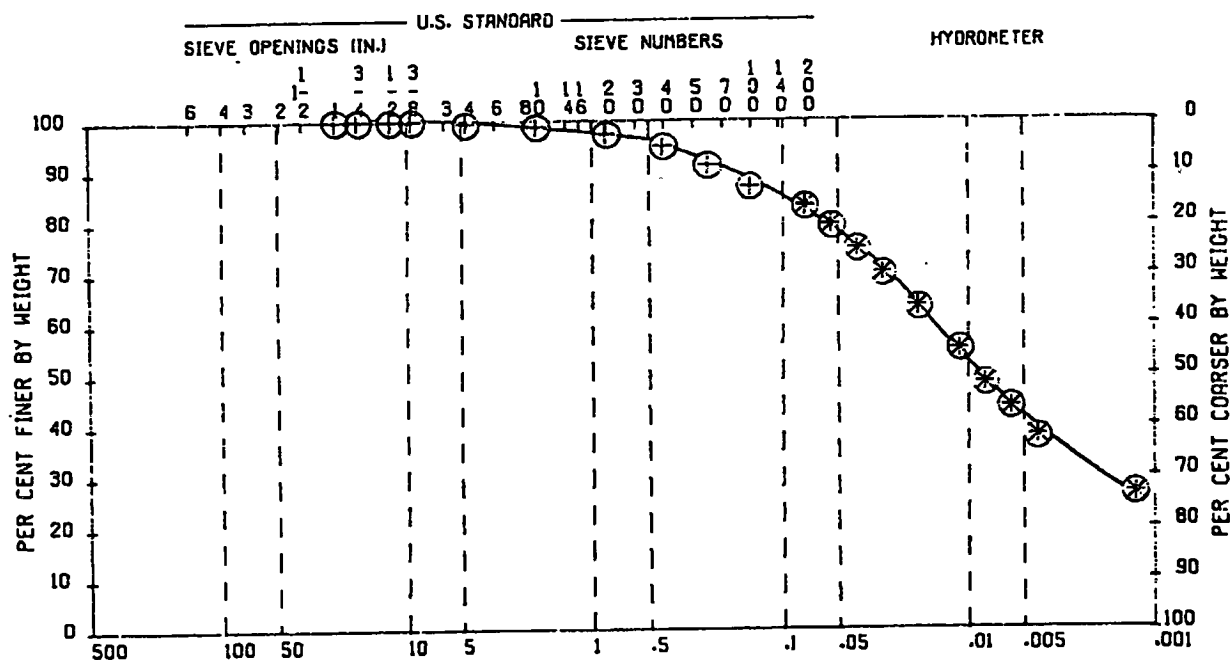
ELAPSED TIME	TEMPERATURE CENTIGRADE	ACTUAL READING	ADJUST READING	GRAIN SIZE	PER CENT FINER
0.25	20.5	49.00	44.00	0.0762	83.32
0.50	20.5	47.00	42.00	0.0549	79.54
1.00	20.5	44.50	39.50	0.0397	74.80
2.00	20.5	42.00	37.00	0.0287	70.07
5.00	20.5	38.50	33.50	0.0187	63.44
15.00	20.5	34.00	29.00	0.0112	54.92
30.00	20.5	30.50	25.50	0.0081	48.29
60.00	20.5	28.00	23.00	0.0059	43.56
120.00	20.5	25.00	20.00	0.0042	37.87
1440.00	20.5	19.00	14.00	0.0013	26.51

DRAFT

GRAIN SIZE DISTRIBUTION (ASTM D 422)

PROJECT :	BFI	ST
BORING/SOURCE:	WINTHROP HARBOR	DA
SAMPLE NUMBER:	1-COMBINED	LL
DEPTH (FEET) :	-	WC
USCS CLASSIFICATION:	(CL)	
SOIL DESCRIPTION :	SILTY CLAY,LITTLE F TO C SAND-BROWNSH GRAY	

STS JOB NO. : 17590-XF
DATE : 11-07-88
LL: - PL: - P1: -
WC: - SP.GR. : 2.73 EST.



GRAIN SIZE IN MILLIMETERS							
COBBLES	GRAVEL			SAND			SILT OR CLAY
	CO	MED	FINE	CO	MEDIUM	FINE	

DRAFT

STS CONSULTANTS, LTD.

GRAIN SIZE DISTRIBUTION (ASTM D 422)

Project : BFI
 Boring/Source: WINTHROP HARBOR
 Sample Number: 2
 Depth (feet): -
 USCS Classification: (CL)
 Soil Description : SILTY CLAY, LITTLE SAND, TRACE GRAVEL-BROWN

STS Job No.: 17590-XF
 Date : 11-07-88
 LL: - PL: - PI: -
 WC: - SP.GR.: 2.75 Est.

SIEVE ANALYSIS --

SAMPLE WEIGHT: 124.62 GRAMS

SIEVE SIZE	WEIGHT RETAINED	PER CENT RETAINED	PER CENT PASSING
1"	0.00	0.00	100.00
.75"	0.00	0.00	100.00
.50"	0.00	0.00	100.00
.375"	1.37	1.10	98.90
#4	0.49	0.39	98.51
#10	1.55	1.24	97.26
#20	2.14	1.72	95.55
#40	2.89	2.32	93.23
#60	3.90	3.13	90.10
#100	3.75	3.01	87.09
#200	1.58	1.27	85.82

HYDROMETER ANALYSIS --

HYDROMETER SAMPLE WEIGHT: 55.30 GRAMS

ELAPSED TIME	TEMPERATURE CENTIGRADE	ACTUAL READING	ADJUST READING	GRAIN SIZE	PER CENT FINER
0.25	20.5	55.00	50.00	0.0711	86.10
0.50	20.5	54.50	49.50	0.0505	85.23
1.00	20.5	53.00	48.00	0.0363	82.65
2.00	20.5	51.00	46.00	0.0262	79.21
5.00	20.5	48.50	43.50	0.0170	74.90
15.00	20.5	42.50	37.50	0.0104	64.57
30.00	20.5	39.00	34.00	0.0076	58.54
60.00	20.5	35.50	30.50	0.0055	52.52
120.00	20.5	31.50	26.50	0.0040	45.63
1440.00	20.5	24.00	19.00	0.0012	32.72



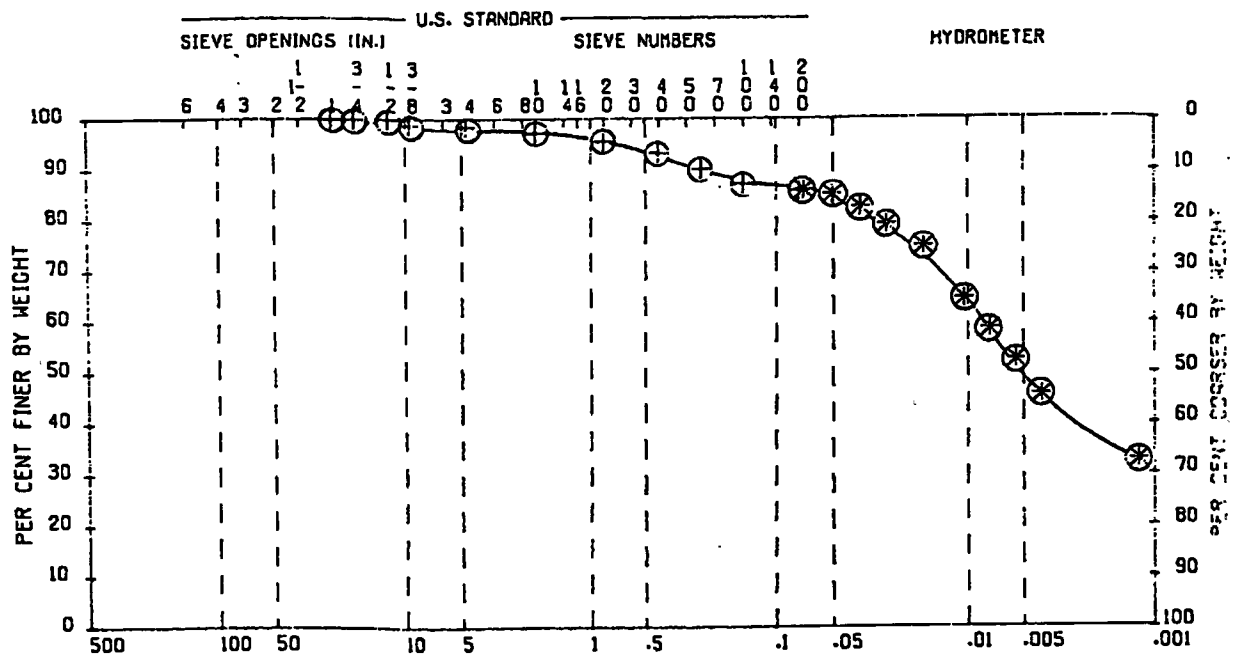
STS Consultants Ltd.

DRAFT

GRAIN SIZE DISTRIBUTION (ASTM D 422)

PROJECT : BFI
 BORING/SOURCE: WINTHROP HARBOR
 SAMPLE NUMBER: 2
 DEPTH (FEET) : -
 USCS CLASSIFICATION: (CL)
 SOIL DESCRIPTION : SILTY CLAY, LITTLE SAND, TRACE GRAVEL-BROWN

STS JOB NO. : 17590-XF
 DATE : 11-07-88
 LL: - PL: - PI: -
 WC: - SP.GR. : 2.75 EST.



DRAFT

STS CONSULTANTS, LTD.

GRAIN SIZE DISTRIBUTION (ASTM D 422)

Project : BFI
 Boring/Source: WINTHROP HARBOR
 Sample Number: 3-COMBINED
 Depth (feet): -
 USCS Classification: (CL)
 Soil Description : SILTY CLAY SOME FINE - COARSE SAND -
 BROWNISH GRAY

STS Job No.: 17590-XF
 Date : 11-07-88
 LL: - PL: - PI: -
 WC: - SP.GR.: 2.75

SIEVE ANALYSIS --

SAMPLE WEIGHT: 114.55 GRAMS

SIEVE SIZE	WEIGHT RETAINED	PER CENT RETAINED	PER CENT PASSING
.375"	0.00	0.00	100.00
#4	1.09	0.95	99.05
#10	1.96	1.71	97.34
#20	2.26	1.97	95.36
#40	4.97	4.34	91.03
#60	9.93	8.67	82.36
#100	6.81	5.95	76.41
#200	2.75	2.40	74.01

HYDROMETER ANALYSIS --

HYDROMETER SAMPLE WEIGHT: 60.12 GRAMS

ELAPSED TIME	TEMPERATURE CENTIGRADE	ACTUAL READING	ADJUST READING	GRAIN SIZE	PER CENT FINER
0.25	20.5	53.00	48.00	0.0727	76.08
0.50	20.5	50.00	45.00	0.0530	71.33
1.00	20.5	47.50	42.50	0.0384	67.36
2.00	20.5	44.50	39.50	0.0279	62.61
5.00	20.5	42.00	37.00	0.0181	58.65
15.00	20.5	36.50	31.50	0.0109	49.93
30.00	20.5	33.00	28.00	0.0079	44.38
60.00	20.5	29.50	24.50	0.0058	38.83
120.00	20.5	26.50	21.50	0.0042	34.08
1440.00	20.5	19.50	14.50	0.0013	22.98



STS Consultants Ltd.

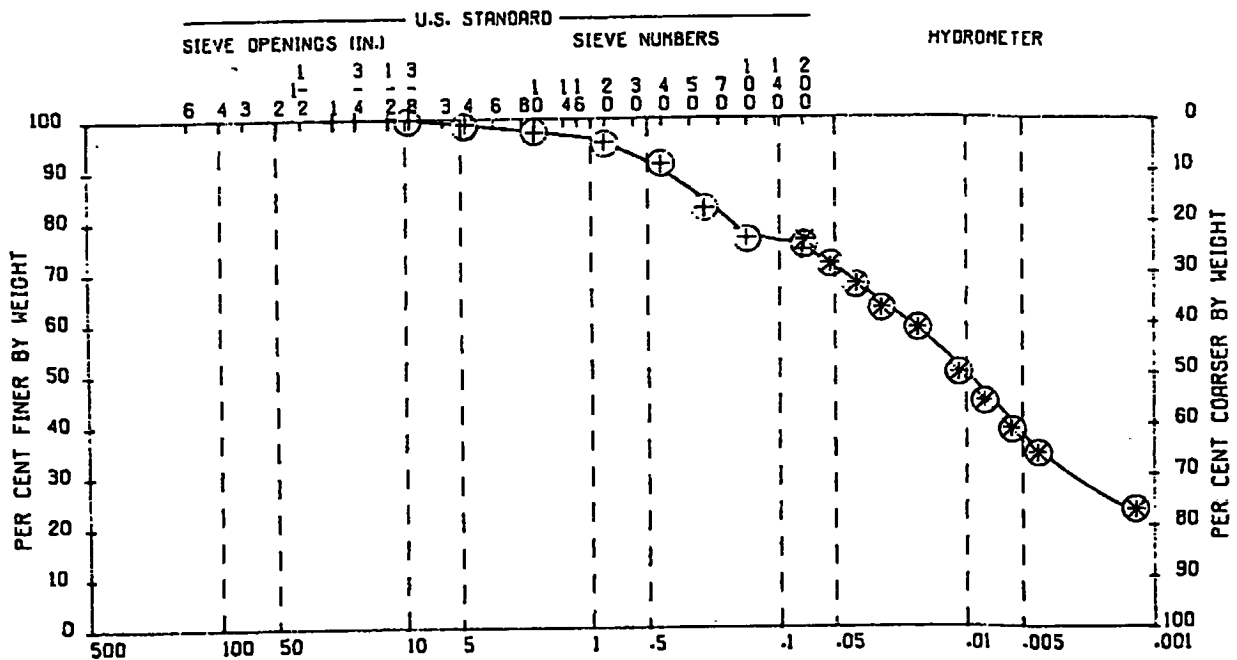
GRAIN SIZE DISTRIBUTION

DRAFT

(ASTM D 422)

PROJECT : 8F1
 BORING/SOURCE: WINTHROP HARBOR
 SAMPLE NUMBER: 3-COMBINED
 DEPTH (FEET): -
 USCS CLASSIFICATION: (CL)
 SOIL DESCRIPTION : SILTY CLAY, SOME FINE TO COARSE SAND-
 BROWNISH-GRAY

STS JOB NO. : 17590-XF
 DATE : 11-07-88
 LL: - PL: - PI: -
 WC: - SP.GR. : 2.75 EST.



STS CONSULTANTS, LTD.

DRAFT

GRAIN SIZE DISTRIBUTION (ASTM D 422)

Project : BFI
 Boring/Source: WINTHROP HARBOR
 Sample Number: 4-COMBINED
 Depth (feet): -
 USCS Classification: (CL)
 Soil Description : SILTY CLAY, SOME F TO C SAND-BROWNISH GRAY

STS Job No.: 17590-XF
 Date : 11-07-88
 LL: - PL: - PI: -
 WC: - SP.GR.: 2.73 Est.

SIEVE ANALYSIS --

SAMPLE WEIGHT: 90.93 GRAMS

SIEVE SIZE	WEIGHT RETAINED	PER CENT RETAINED	PER CENT PASSING
1"	0.00	0.00	100.00
.75"	0.00	0.00	100.00
.50"	0.00	0.00	100.00
.375"	0.00	0.00	100.00
#4	0.49	0.54	99.46
#10	3.56	3.92	95.55
#20	2.77	3.05	92.50
#40	3.55	3.90	88.60
#60	4.44	4.88	83.71
#100	5.00	5.50	78.21
#200	3.23	3.55	74.66

HYDROMETER ANALYSIS --

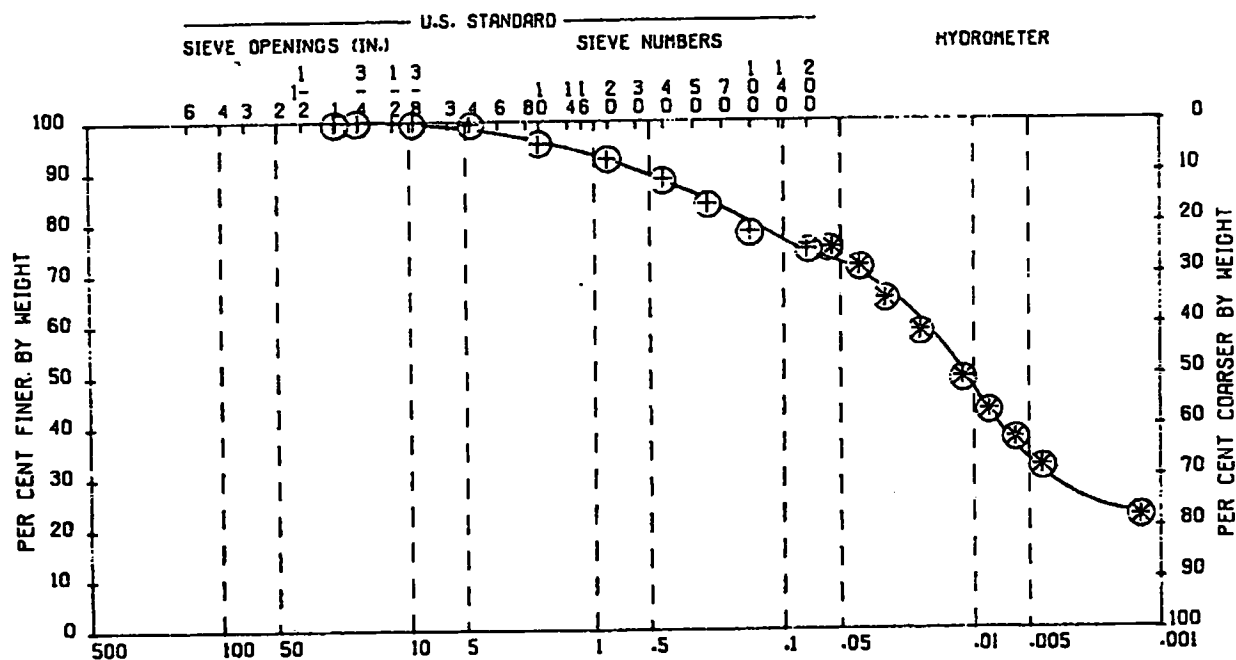
HYDROMETER SAMPLE WEIGHT: 51.33 GRAMS

ELAPSED TIME	TEMPERATURE CENTIGRADE	ACTUAL READING	ADJUST READING	GRAIN SIZE	PER CENT FINER
0.50	20.5	46.00	41.00	0.0554	75.03
1.00	20.5	44.00	39.00	0.0399	71.37
2.00	20.5	40.50	35.50	0.0291	64.96
5.00	20.5	37.00	32.00	0.0190	58.56
15.00	20.5	32.00	27.00	0.0114	49.41
30.00	20.5	28.50	23.50	0.0082	43.00
60.00	20.5	25.50	20.50	0.0060	37.51
120.00	20.5	22.50	17.50	0.0043	32.02
1440.00	20.5	17.00	12.00	0.0013	21.96

GRAIN SIZE DISTRIBUTION (ASTM D 422)

DRAFT

STS JOB NO. : 17590-XF
DATE : 11-07-88
LL: - PL: - PI: -
WC: - SP.GR. : 2.73 EST.



GRAIN SIZE IN MILLIMETERS							
COBBLES	GRAVEL			SAND			SILT OR CLAY
	CO	MED	FINE	CO	MEDIUM	FINE	

STS CONSULTANTS, LTD.

DRAFT

GRAIN SIZE DISTRIBUTION (ASTM D 422)

Project : BFI
 Boring/Source: WINTHROP HARBOR
 Sample Number: 5-COMBINED
 Depth (feet): -
 USCS Classification: (CL)
 Soil Description : SILTY CLAY, SOME F TO C SAND, TRACE F GRAVEL-
 BROWNISH GRAY

STS Job No.: 17590-XF
 Date : 11-07-88
 LL: - PL: - PI: -
 WC: - SP.GR.: 2.73 Est.

SIEVE ANALYSIS --

SAMPLE WEIGHT: 74.70 GRAMS

SIEVE SIZE	WEIGHT RETAINED	PER CENT RETAINED	PER CENT PASSING
1"	0.00	0.00	100.00
.75"	0.00	0.00	100.00
.50"	0.00	0.00	100.00
.375"	0.00	0.00	100.00
#4	0.87	1.16	98.84
#10	2.14	2.86	95.97
#20	1.64	2.20	93.78
#40	2.53	3.39	90.39
#60	3.06	4.10	86.29
#100	3.72	4.98	81.31
#200	2.04	2.73	78.58

HYDROMETER ANALYSIS --

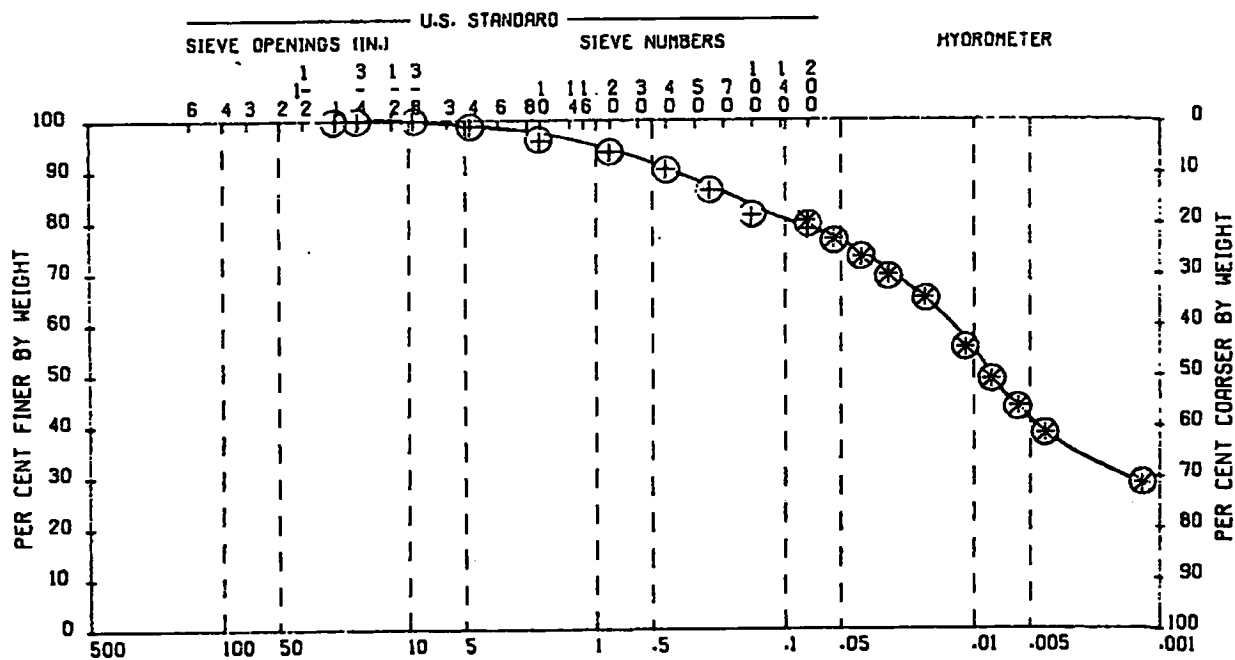
HYDROMETER SAMPLE WEIGHT: 52.91 GRAMS

ELAPSED TIME	TEMPERATURE CENTIGRADE	ACTUAL READING	ADJUST READING	GRAIN SIZE	PER CENT FINER
0.25	20.5	50.00	45.00	0.0754	80.24
0.50	20.5	48.00	43.00	0.0544	76.68
1.00	20.5	46.00	41.00	0.0392	73.11
2.00	20.5	44.00	39.00	0.0282	69.55
5.00	20.5	41.50	36.50	0.0183	65.09
15.00	20.5	36.00	31.00	0.0110	55.28
30.00	20.5	32.50	27.50	0.0080	49.04
60.00	20.5	29.50	24.50	0.0058	43.69
120.00	20.5	26.50	21.50	0.0042	38.34
1440.00	20.5	21.00	16.00	0.0013	28.53

GRAIN SIZE DISTRIBUTION (ASTM D 422)

DRAFT

STS JOB NO. : 17590-XF
DATE : 11-07-88
LL: - PL: - PI: -
WC: - SP.GR. : 2.73 EST.



GRAIN SIZE IN MILLIMETERS							
COBBLES	GRAVEL			SAND			SILT OR CLAY
	CO	MED	FINE	CO	MEDIUM	FINE	

DRAFT

STS CONSULTANTS, LTD.

GRAIN SIZE DISTRIBUTION (ASTM D 422)

Project : BFI
 Boring/Source: WINTHROP HARBOR
 Sample Number: 6-COMBINED
 Depth (feet): -
 USCS Classification: (CL)
 Soil Description : SILTY CLAY, SOME FINE TO COARSE SAND-
 BROWNISH GRAY

STS Job No.: 17590-XF
 Date : 11-07-88
 LL: - PL: - PI: -
 WC: - SP.GR.: 2.75 Est.

SIEVE ANALYSIS --

SAMPLE WEIGHT: 108.25 GRAMS

SIEVE SIZE	WEIGHT. RETAINED	PER CENT RETAINED	PER CENT PASSING
1"	0.00	0.00	100.00
.75"	0.00	0.00	100.00
.50"	0.00	0.00	100.00
.375"	0.00	0.00	100.00
#4	0.72	0.67	99.33
#10	3.35	3.09	96.24
#20	4.01	3.70	92.54
#40	3.98	3.68	88.86
#60	5.72	5.28	83.58
#100	6.24	5.76	77.81
#200	2.83	2.61	75.20

HYDROMETER ANALYSIS --

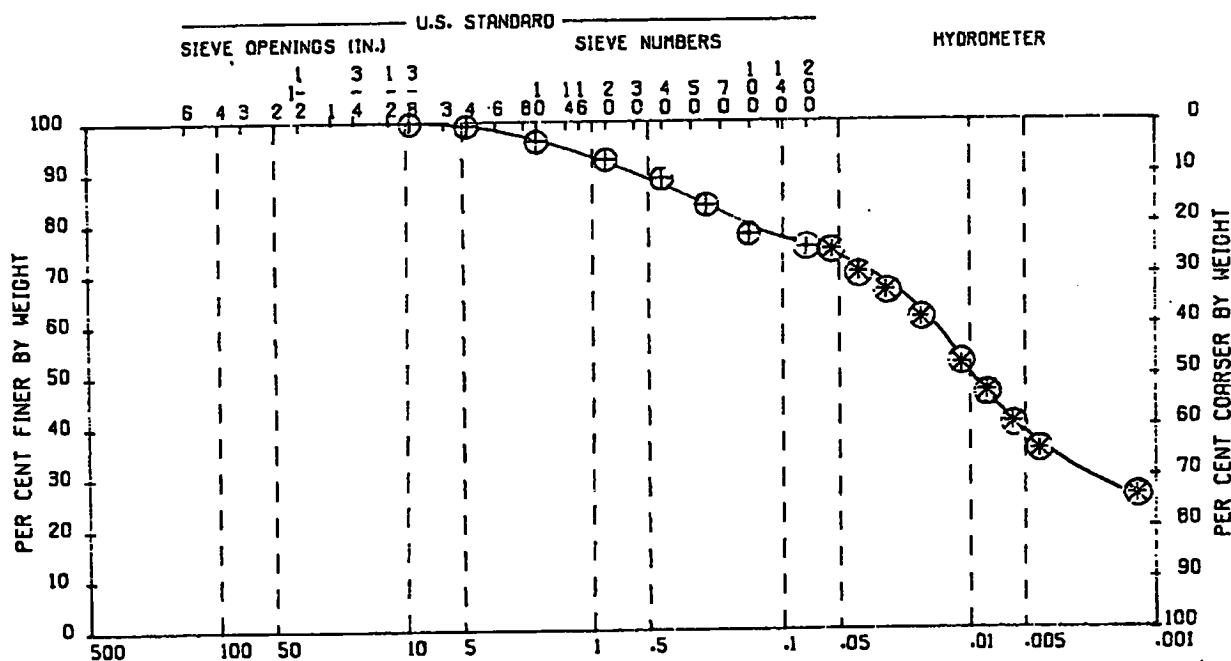
HYDROMETER SAMPLE WEIGHT: 52.35 GRAMS

ELAPSED TIME	TEMPERATURE CENTIGRADE	ACTUAL READING	ADJUST READING	GRAIN SIZE	PER CENT FINER
0.50	20.5	46.50	41.50	0.0549	74.69
1.00	20.5	44.00	39.00	0.0397	70.19
2.00	20.5	42.00	37.00	0.0286	66.59
5.00	20.5	39.00	34.00	0.0185	61.19
15.00	20.5	34.00	29.00	0.0111	52.19
30.00	20.5	31.00	26.00	0.0081	46.79
60.00	20.5	27.50	22.50	0.0058	40.50
120.00	20.5	24.50	19.50	0.0042	35.10
1440.00	20.5	19.50	14.50	0.0013	26.10

GRAIN SIZE DISTRIBUTION (ASTM D 422)

DRAFT

STS JOB NO. : 17590-XF
DATE : 11-07-88
LL: - PL: - PI: -
WC: - SP.GR. : 2.75 EST.



GRAIN SIZE IN MILLIMETERS							
COBBLES	GRAVEL			SAND			SILT OR CLAY
	CO	MED	FINE	CO	MEDIUM	FINE	

STS CONSULTANTS, LTD.

GRAIN SIZE DISTRIBUTION (ASTM D 422)

DRAFT

Project : BFI
 Boring/Source: WINTHROP HARBOR
 Sample Number: 7-COMBINED
 Depth (feet): -

STS Job No.: 17590-XF
 Date : 11-07-88
 LL: - PL: - PI: -
 WC: - SP.GR.: 2.73 Est.

USCS Classification: (CL)

Soil Description : SILTY CLAY, LITTLE F TO C SAND, TRACE F GRAVEL-
 BROWNISH GRAY

SIEVE ANALYSIS --

SAMPLE WEIGHT: 99.06 GRAMS

SIEVE SIZE	WEIGHT RETAINED	PER CENT RETAINED	PER CENT PASSING
1"	0.00	0.00	100.00
.75"	0.00	0.00	100.00
.50"	0.00	0.00	100.00
.375"	0.00	0.00	100.00
#4	2.61	2.63	97.37
#10	2.32	2.34	95.02
#20	2.14	2.16	92.86
#40	2.76	2.79	90.08
#60	3.54	3.57	86.50
#100	3.61	3.64	82.86
#200	2.03	2.05	80.81

HYDROMETER ANALYSIS --

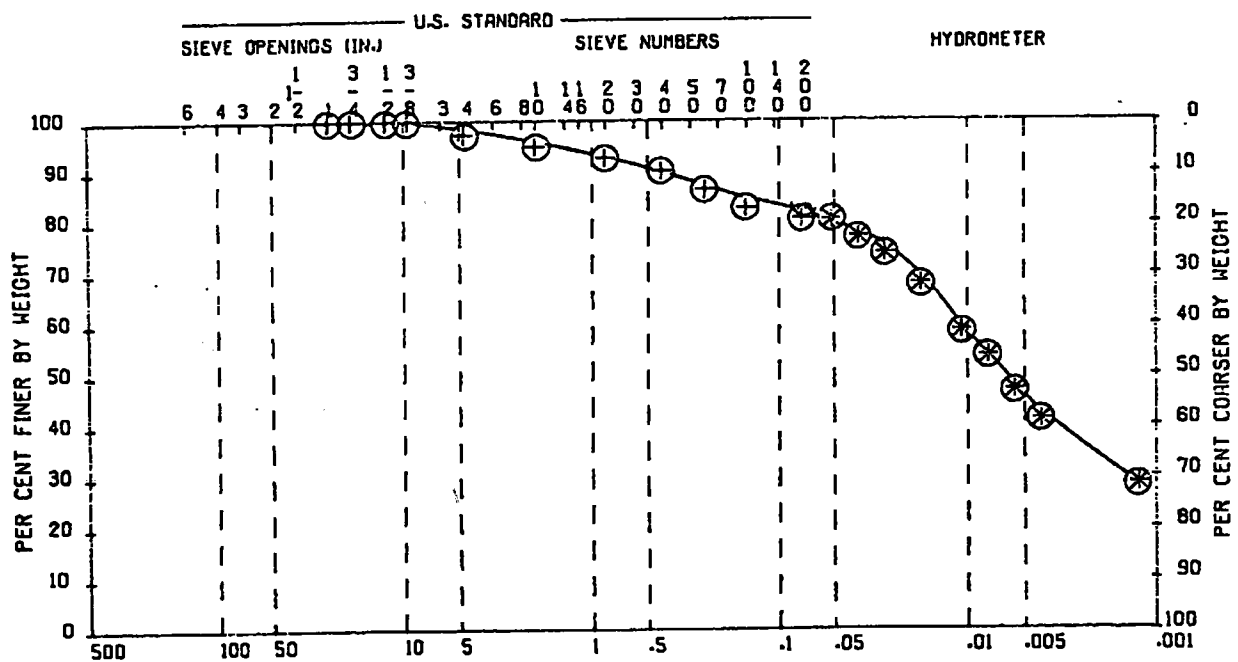
HYDROMETER SAMPLE WEIGHT: 55.61 GRAMS

ELAPSED TIME	TEMPERATURE CENTIGRADE	ACTUAL READING	ADJUST READING	GRAIN SIZE	PER CENT FINER
0.25	20.5	55.00	50.00	0.0715	83.99
0.50	20.5	53.00	48.00	0.0517	80.63
1.00	20.5	51.00	46.00	0.0373	77.28
2.00	20.5	48.00	44.00	0.0263	73.92
5.00	20.5	45.50	40.50	0.0176	68.04
15.00	20.5	40.00	35.00	0.0107	58.80
30.00	20.5	37.00	32.00	0.0077	53.76
60.00	20.5	33.00	28.00	0.0056	47.04
120.00	20.5	29.50	24.50	0.0041	41.16
1440.00	20.5	22.00	17.00	0.0012	28.56

DRAFT

PROJECT :	BF1	STS
BORING/SOURCE:	WINTHROP HARBOR	DATE
SAMPLE NUMBER:	7-COMBINED	LL:
DEPTH (FEET) :	-	WC:
USCS CLASSIFICATION:	(CL)	
SOIL DESCRIPTION :	SILTY CLAY,LITTLE F TO C SAND,TRACE F GRAVEL- BROWNISH GRAY	

STS JOB NO. : 17590-XF
DATE : 11-07-88
LL: - PL: - PI: -
WC: - SP.GR. : 2.73 EST.



GRAIN SIZE IN MILLIMETERS							
COBBLES	GRAVEL			SAND			SILT OR CLAY
	CO	MED	FINE	CO	MEDIUM	FINE	

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GRAIN SIZE DISTRIBUTION (ASTM D 422)

Project : BFI WINTHROP HARBOR

STS Job No.: 17590-XF

Boring/Source: BORROW PIT #1

Date : 11-28-88

Sample Number: -

LL: - PL: - PI: -

Depth (feet): -

WC: - SP.GR.: 2.73 Est.

USCS Classification: (CL)

Soil Description : SILTY CLAY LITTLE FINE - COARSE SAND TRACE
FINE GRAVEL - GRAY

SIEVE ANALYSIS --

SAMPLE WEIGHT: 77.40 GRAMS

SIEVE SIZE	WEIGHT RETAINED	PER CENT RETAINED	PER CENT PASSING
.375"	0.00	0.00	100.00
#4	2.17	2.80	97.20
#10	1.27	1.64	95.56
#20	1.34	1.73	93.82
#40	1.29	1.67	92.16
#60	1.54	1.99	90.17
#100	2.08	2.69	87.48
#200	2.04	2.64	84.84

HYDROMETER ANALYSIS --

HYDROMETER SAMPLE WEIGHT: 51.75 GRAMS

ELAPSED TIME	TEMPERATURE CENTIGRADE	ACTUAL READING	ADJUST READING	GRAIN SIZE	PER CENT FINER
0.25	22.5	52.00	47.00	0.0721	85.32
0.50	22.5	51.00	46.00	0.0515	83.50
1.00	22.5	49.50	44.50	0.0370	80.78
2.00	22.5	47.50	42.50	0.0267	77.15
5.00	22.5	46.00	41.00	0.0171	74.43
20.00	22.5	40.00	35.00	0.0090	63.54
30.00	22.5	37.00	32.00	0.0076	58.09
60.00	22.5	33.50	28.50	0.0055	51.74
120.00	22.5	30.50	25.50	0.0040	46.29
240.00	22.5	28.50	23.50	0.0028	42.66
1440.00	22.5	26.00	21.00	0.0012	38.12



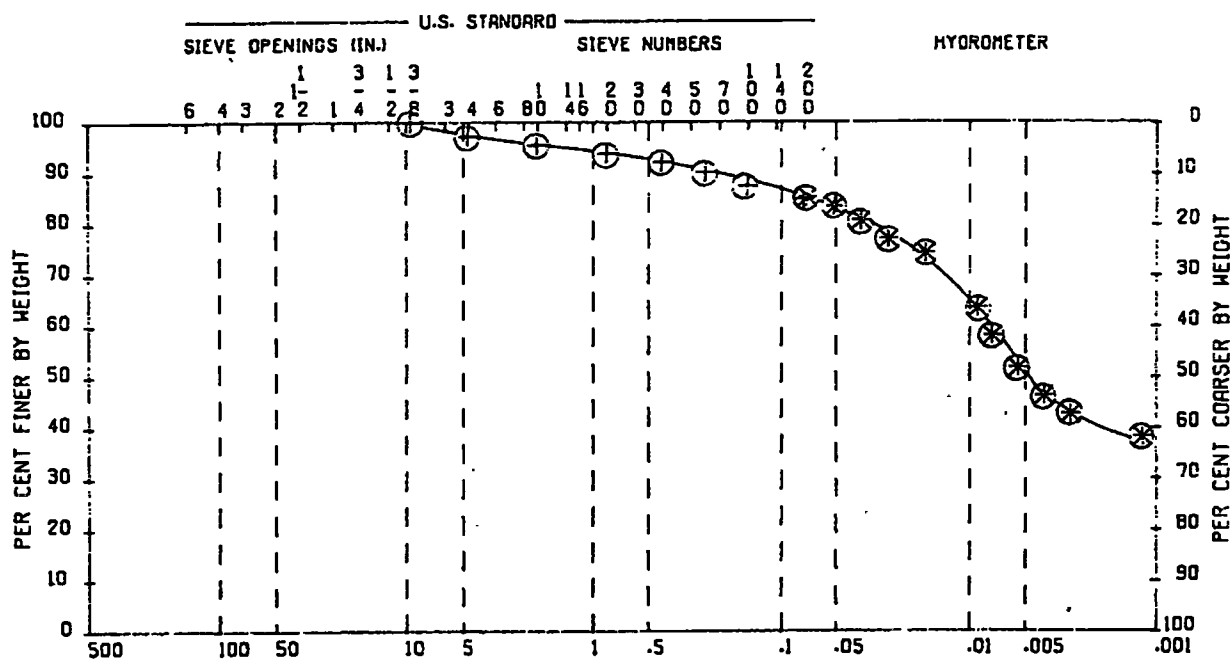
STS Consultants Ltd.

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GRAIN SIZE DISTRIBUTION (ASTM D 422)

PROJECT : BFI WINTHROP HARBOR
 BORING/SOURCE: BORROW PIT #1
 SAMPLE NUMBER: -
 DEPTH (FEET): -
 USCS CLASSIFICATION: (CL)
 SOIL DESCRIPTION : SILTY CLAY LITTLE FINE - COARSE SAND TRACE
 FINE GRAVEL - GRAY

STS JOB NO. : 17590-XF
 DATE : 11-28-88
 LL: - PL: - PI: -
 WC: - SP.GR. : 2.73 EST.



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GRAIN SIZE DISTRIBUTION (ASTM D 422)

Project : BFI WINTHROP HARBOR
 Boring/Source: BORROW PIT #2
 Sample Number: -
 Depth (feet): -
 USCS Classification: (CL)
 Soil Description : SILTY CLAY LITTLE FINE - MEDIUM SAND - GRAY
 MOTTLED OLIVE & YELLOW BROWN

STS Job No.: 17590-XF
 Date : 11-29-88
 LL: - PL: - PI: -
 WC: - SP.GR.: 2.74 Est.

SIEVE ANALYSIS --

SAMPLE WEIGHT: 92.77 GRAMS

SIEVE SIZE	WEIGHT RETAINED	PER CENT RETAINED	PER CENT PASSING
#4	0.00	0.00	100.00
#10	0.39	0.42	99.58
#20	1.14	1.23	98.35
#40	1.77	1.91	96.44
#60	2.65	2.86	93.59
#100	2.76	2.98	90.61
#200	1.31	1.41	89.20

HYDROMETER ANALYSIS --

HYDROMETER SAMPLE WEIGHT: 52.20 GRAMS

ELAPSED TIME	TEMPERATURE CENTIGRADE	ACTUAL READING	ADJUST READING	GRAIN SIZE	PER CENT FINER
0.25	22.5	53.00	48.00	0.0712	89.83
0.50	22.5	52.00	47.00	0.0509	87.96
1.00	22.5	51.00	46.00	0.0363	86.09
2.00	22.5	50.00	45.00	0.0260	84.22
5.00	22.5	47.00	42.00	0.0169	78.60
15.00	22.5	44.00	39.00	0.0100	72.99
30.00	22.5	40.50	35.50	0.0073	66.44
60.00	22.5	37.00	32.00	0.0053	59.89
120.00	22.5	34.00	29.00	0.0039	54.27
240.00	22.5	32.50	27.50	0.0028	51.47
1440.00	22.5	29.00	24.00	0.0012	44.92

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GRAIN SIZE DISTRIBUTION (ASTM D 422)

Project : BFI STS Job No.: 17590-XH
 Boring/Source: Boring 3, Combined with 20% Barrow Date : 12-20-88
 Sample Number: #2 Material, 1% Bentonite Added and LL: - PL: - PI: -
 Depth (feet): Enough Slurry to Obtain 4-6in. Slump WC: - SP.GR.: 2.76 Est
 USCS Classification: (CL)
 Soil Description : SILTY CLAY, SOME F TO C SAND, TRACE F GRAVEL-
 BROWNISH GRAY

SIEVE ANALYSIS --

SAMPLE WEIGHT: 66.71 GRAMS

SIEVE SIZE	WEIGHT RETAINED	PER CENT RETAINED	PER CENT PASSING
.50"	0.00	0.00	100.00
.375"	3.25	4.87	95.13
#4	3.39	5.08	90.05
#10	2.13	3.19	86.85
#20	2.27	3.40	83.45
#40	2.17	3.25	80.20
#60	2.47	3.70	76.50
#100	2.86	4.29	72.21
#200	2.20	3.30	68.91

HYDROMETER ANALYSIS --

HYDROMETER SAMPLE WEIGHT: 51.77 GRAMS

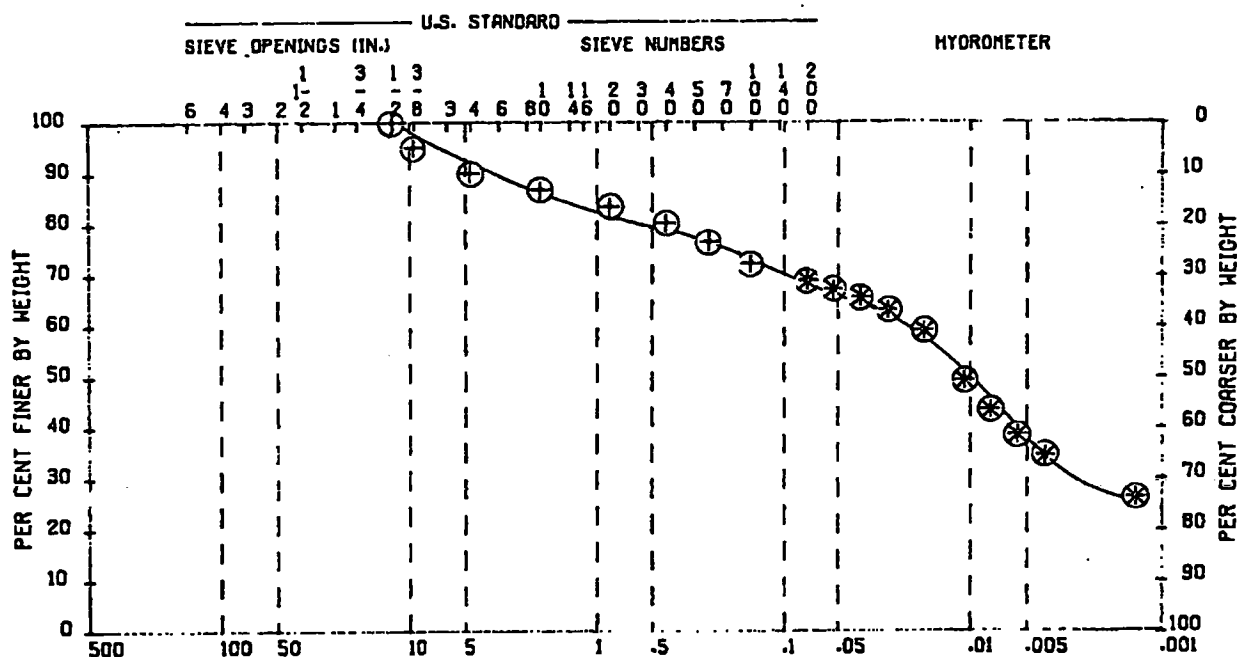
ELAPSED TIME	TEMPERATURE CENTIGRADE	ACTUAL READING	ADJUST READING	GRAIN SIZE	PER CENT FINER
0.25	23.0	47.00	42.00	0.0748	68.84
0.50	23.0	46.00	41.00	0.0534	67.20
1.00	23.0	45.00	40.00	0.0381	65.56
2.00	23.0	43.50	38.50	0.0273	63.10
5.00	23.0	41.00	36.00	0.0176	59.01
15.00	23.0	35.00	30.00	0.0107	49.17
30.00	23.0	31.50	26.50	0.0078	43.43
60.00	23.0	28.50	23.50	0.0056	38.52
120.00	23.0	26.00	21.00	0.0040	34.42
1105.00	23.0	21.00	16.00	0.0014	26.22

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GRAIN SIZE DISTRIBUTION (ASTM D 422)

PROJECT : 8F1 ST
BORING/SOURCE: Boring 3, Combined with 20% Barrow #2 DA
SAMPLE NUMBER: Material, 1% Bentonite, and Enough LL
DEPTH (FEET): Slurry Added to Obtain 4-6in. Slump WC
USCS CLASSIFICATION: (CL)
SOIL DESCRIPTION : SILTY CLAY, SOME F TO C SAND, TRACE F GRAVEL-
BROWNISH GRAY

STS JOB NO. : 17590-XH
DATE : 12-20-88
LL: - PL: - PI: -
WC: - SP.GR. : 2.76 EST.



GRAIN SIZE IN MILLIMETERS						SILT OR CLAY
COBBLES	GRAVEL			SAND		
	CO	MED	FINE	CO	FINE	

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STS Job No. 17590-XFProject BFI Winthrop HarborCase International Co.Date 11-7-88**SUMMARY OF PERMEABILITY TEST RESULTS**

Boring No.	B-1	B-4	B-4	B-1 S-6
Sample No.	Combined	Combined	Combined	B-3 S-6
Depth (ft)	with 4% Slurry		With 4% Slurry	B-5 S-6 B-7 S-4
Classification	Silty Clay Little F-C Sand - Brownish Gray	Silty Clay Some F-C Sand - Brownish Gray	Silty Clay Some F-C Sand - Brownish Gray	Silty Clay Trace f-m Sand - Gray
Dry Unit Weight (pcf)	69.9	116.1	70.5	117.3
Water Content (%)	46.5	14.0	34.6	16.2
Diameter (cm)	4.751	4.725	4.723	4.872
Length (cm)	6.712	6.152	7.351	6.144
Saturation E Value	0.96	0.97	0.99	0.96
Permeability K cm/sec	6×10^{-7}	3×10^{-7}	1×10^{-6}	4×10^{-8}

Note: The Specimens mixed with the 4% bentonite slurry had enough slurry added to obtain a 4 to 6 inch slump. The material was mixed long enough to obtain a homogenous texture.

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STS Job No. 17590-XF
 Project BFI Winthrop Harbor
Landfill
 Date 11-28-88

SUMMARY OF PERMEABILITY TEST RESULTS

Boring No.	Boring 4 Combined	Boring 4 Combined	Boring 3 Combined
Sample No.	1% Bentonite 20% Borrow 1	1% Bentonite 10% Borrow 2	1% Bentonite 20% Borrow 2
Depth (ft)	4% Slurry Added To Obtain 4-6 Inch Slump	4% Slurry Added To Obtain 4-6 Inch Slump	4% Slurry Added To Obtain 4-6 Inch Slump
Classification	Soil/Bentonite Slurry	Soil/Bentonite Slurry	Soil/Bentonite Slurry
Dry Unit Weight (pcf)	72.0	73.1	74.7
Water Content (%)	29.8	33.9	44.0
Diameter (cm)	3.436	3.436	3.475
Length (cm)	5.043	5.003	5.554
Saturation ≡ Value	0.98	0.95	1.00
Permeability K cm/sec	5×10^{-7}	6×10^{-8}	5×10^{-8}

All Specimens Consolidated With 3 PSI Consolidating Stress.
 Tests Performed in Triaxial Apparatus.

STS General Notes



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DRILLING & SAMPLING SYMBOLS:

SS : Split Spoon-1 3/8" I.D., 2" O.D.
 Unless otherwise noted
 ST : Shelby Tube-2" O.D.,
 Unless otherwise noted
 PA : Power Auger
 DB : Diamond Bit-NX, BX, AX
 AS : Auger Sample
 JS : Jar Sample
 VS : Vane Shear

OS : Osterberg Sampler-3" Shelby Tube
 HS : Hollow Stem Auger
 WS : Wash Sample
 FT : Fish Tail
 RB : Rock Bit
 BS : Bulk Sample
 PM : Pressuremeter Test, In-Situ
 GS : Giddings Sampler

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler, except where otherwise noted.

WATER LEVEL MEASUREMENT SYMBOLS:

WL : Water Level
 WS : While Sampling
 WD : While Drilling
 AB : After Boring

WCI : Wet Cave In
 DCI : Dry Cave In
 BCR : Before Casing Removal
 ACR : After Casing Removal

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious soils, the indicated elevations are considered reliable groundwater levels. In impervious soils, the accurate determination of groundwater elevations may not be possible, even after several days of observations; additional evidence of groundwater elevations must be sought.

GRADATION DESCRIPTION & TERMINOLOGY:

Coarse Grained or Granular Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays or clayey silts if they are cohesive and silts if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

Major Component Of Sample	Size Range	Description Of Components Also Present in Sample	Percent Of Dry Weight
Boulders	Over 8 in. (200 mm)	Trace	1-9
Cobbles	8 inches to 3 inches (200 mm to 75 mm)	Little	10-19
Gravel	3 inches to #4 sieve (75 mm to 4.75 mm)	Some	20-34
Sand	#4 to #200 sieve (4.75 mm to 0.075 mm)	And	35-50
Silt	Passing #200 sieve (0.075 mm to 0.005 mm)		
Clay	Smaller than 0.005 mm		

CONSISTENCY OF COHESIVE SOILS:

Unconfined Compressive Strength, Qu, tsf	Consistency
0.25	Very Soft
0.25-0.49	Soft
0.50-0.99	Medium (Firm)
1.00-1.99	Stiff
2.00-3.99	Very Stiff
4.00-8.00	Hard
> 8.00	Very Hard

RELATIVE DENSITY OF GRANULAR SOILS:

N-Blows per ft.	Relative Density
0-3	Very Loose
4-9	Loose
10-29	Medium Dense
30-49	Dense
50-80	Very Dense
> 80	Extremely Dense

STS Soil Classification System

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UNIFIED SOIL CLASSIFICATION

Major Divisions			Group symbols	Typical names	Laboratory classification criteria			
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 per cent GW, GP, SW, SP More than 5 per cent GM, GC, SM, SC 5 to 12 per cent Borderline cases requiring dual symbols	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3		
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW		
		Gravels with fines (Appreciable amount of fines)	GM	d u		Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are <i>borderline</i> cases requiring use of dual symbols
			GC			Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7	
		Clean sands (Little or no fines)	SW			Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP			Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW	
	Sands with fines (Appreciable amount of fines)	SM	d u	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are <i>borderline</i> cases requiring use of dual symbols	
		SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7		
	Fine-grained soils (More than half of material is smaller than No. 200 sieve)	Silt and clays (Liquid limit less than 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity		For classification of fine-grained soils and fine fraction of coarse-grained soils. Atterberg Limits plotting in hatched area are <i>borderline</i> classifications requiring use of dual symbols. Equation of A-line: PI = 0.73 (LL - 20)		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays				
OL			Organic silts and organic silty clays of low plasticity					
Silt and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts					
		CH	Inorganic clays of high plasticity, fat clays					
		OH	Organic clays of medium to high plasticity, organic silts					
Highly organic soils		Pe	Peat and other highly organic soils					

Appendix B

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APPENDIX B

Quality Assurance Manual for the Construction of a
Slurry Trench Cutoff Wall

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**QUALITY ASSURANCE MANUAL
FOR THE
CONSTRUCTION OF A SLURRY TRENCH CUTOFF WALL
AT
WINTHROP HARBOR WASTE MANAGEMENT FACILITY**

DECEMBER 1988

Prepared for:

**Browning-Ferris Industries
Illinois Region
Schaumburg, Illinois**

Prepared by:

**Foth & Van Dyke
Geosciences & Environmental
Management Division
Green Bay, Wisconsin**

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1.0 INTRODUCTION

1.1 Terms of Reference

1.1.1 Purpose

This manual addresses the quality assurance of the construction of a slurry trench cutoff wall at the Winthrop Harbor Waste Management Facility, Zion, Illinois.

Site specific construction (installation) specifications were prepared by Browning-Ferris Industries (BFI).

1.1.2 Quality Assurance and Quality Control

This manual is devoted to quality assurance, and quality control.

In the context of the slurry trench cutoff wall installation:

- Quality assurance refers to means and actions employed by the Resident Geotechnical Engineer to assure conformance with the project requirements and specifications. Quality assurance is provided by a party independent from production and installation.
- Quality control refers to those actions taken by the manufacturer and contractor to ensure that the materials and workmanship meet the requirements of the plans and specifications. Quality control is provided by the manufacturer and contractor.

DRAFT**1.1.3 Definitions**

Company: Browning-Ferris Industries of Illinois, Inc. 1827 Walden Office Square, Suite 107, Schaumburg, Illinois 60173.

Engineer: Dan Spikula with Browning-Ferris Industries, Inc., Engineering Services Department, 757 N. Eldridge at Memorial, Houston, Texas 77079, telephone (713) 870-8100, and Mike Williams at the regional office (312) 397-7785.

Resident Geotechnical: Company's on-site technical representative (Foth & Van Dyke) responsible for quality assurance surveillance and testing in accordance with project requirements and specifications: observing, evaluating, and documenting geotechnical conditions encountered during construction; and conducting other investigations and evaluations as requested by the Company.

Contractor: The organization which is furnishing the materials, equipment, design, and construction of the cutoff wall and gravity control testing needed for slurry trench construction is Case International Inc.

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Cutoff Wall Specialist: Contractor's employee/representative who will be on-site throughout construction, is experienced and competent in cutoff wall design and construction, and will perform quality control, ensure specification compliance, and be responsible for the technical performance of the Contractor's operation and product.

Soil-Bentonite Slurry Trench Cutoff: A soil-bentonite slurry trench cutoff is a three (3) foot minimum width trench excavated in the existing overburden and/or fill by the slurry method of excavation and backfilled with a specified material to form a barrier with a permeability equal to or less than 1×10^{-7} cm/sec; hereafter referred to as a cutoff wall.

Slurry Method of Excavation: The slurry method of excavation consists of excavating a vertical wall trench in the overburden and/or fill while at the same time keeping the trench filled with bentonite water slurry; the basic purpose of the slurry being to provide support for the walls of the trench.

Slurry: The slurry is a stable colloidal thixotropic suspension of powdered bentonite in water.

DRAFT**Bentonite:**

Bentonite is a natural clay whose principal mineral constituent is sodium montmorillonite.

Surface Water:

Surface water is used to denote all waters that enter the work area above the existing ground surface from either natural or artificial sources.

Groundwater:

Groundwater denotes all water below the existing ground surface within the work area.

Working Surface:

The working surface is the surface on which the equipment shall operate to construct the cutoff wall. The slope of this surface shall be such that it does not cause slurry in any part of the open trench to be more than two feet below the top of the trench.

Backfill:

The blended mixture of bentonite-water slurry and select materials excavated from the trench and/or supplied from a designated borrow area.

Select Materials:

Materials excavated from the trench or obtained from on-site or off-site borrow and suitable for use in the backfill.

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2.0 DOCUMENTATION

2.1 Introduction

This section is divided into four subsections:

- **Slurry Testing:** Includes requirements pertaining to sampling locations, frequency, and field tests.
- **Backfill Testing:** Includes requirements pertaining to sampling locations, frequency, and field tests.
- **Backfill Sampling:** Includes requirements pertaining to sampling locations and frequency.
- **Trench Excavation:** Includes descriptions of procedures to control various requirements and forms for documenting construction activities, dates, locations, elevations, photos, surveys, etc.

2.2 Slurry Testing

2.2.1 Requirements

1. Bentonite powder shall be mixed with water in a colloidal mixer or other high energy equipment that achieves complete dispersion. The slurry should be hydrated before introduction into the trench.
2. Bentonite shall be a pulverized premium grade natural sodium Wyoming bentonite and shall meet API specification 13A.
3. Water source will be approved by the resident engineer.

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4. Bentonite content shall be a minimum four percent by weight of water and the density of slurry introduced into the trench shall be a minimum 64 pcf.

Note: at four percent bentonite content the density is ~~62.4~~
 $62.4 [(1.04)/(1 + .04/2.5)] = 63.87 \text{ pcf}$

5. Marsh Funnel viscosity of the fully hydrated slurry shall be at least 40 seconds.
6. The slurry shall not lose more than 15 cc of fluid during the filter press test (100 psi 30 minutes duration).

2.2.2 Frequency and Locations

(See Table No. -1).

Client: _____
Project: _____

TABLE NO. 1
Quality Assurance Tests

Test	Location	Frequency	Remarks
Density	Slurry from holding tank	4 times/day min. or as required	Determine density whenever additional slurry is placed or when slurry is reconditioned.
Density	Slurry in trench close to its bottom	2 times/day	
Marsh Funnel Viscosity	Slurry from holding tank	4 times/day min. or as required	Determine viscosity whenever additional slurry is placed or when slurry is reconditioned.
Marsh Funnel Viscosity	Slurry in trench close to the surface	2 times/day	
Fluid Loss	Slurry from holding tank	2 times/day	
Fluid Loss	Slurry from trench close to the surface	2 times/day	

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2.3 Backfill Tests

2.3.1 Requirements

1. Backfill will consist of a mixture of soil excavated from the trench, dry bentonite and slurry. The mixture will be blended well to obtain a homogeneous backfill.
2. The backfill material just prior to placement shall have a consistency of wet concrete with a slump of four to six inches as determined per ASTM C143-79.
3. No frozen backfill will be placed in the slurry trench.
4. Minimum fines content (P200) shall be 69.0 percent, according to contractor's design.
5. The backfill should be plastic to permit rolling to a 1/8-inch thread.

2.3.2 Frequency and Locations of Field Tests

<u>Test</u>	<u>Location</u>	<u>Frequency</u>	<u>Remarks</u>
Density	Mixing Pad	One per batch (one per day minimum)	Retest if recondition- ing is done
Slump	Mixing Pad	One per batch (one per day minimum)	Retest if recondition- ing is done

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Fines	Mixing Pad	One per batch	Retest if
Content			recondition-
			ing is done

2.4 Backfill Sampling

2.4.1 Requirements

1. Twelve (12) backfill samples required for gradation and Atterberg limit tests.
2. Four (4) backfill samples required for laboratory test for permeability.

2.4.2 Location, Identification and Disposition

1. Samples No. GC1 through GC12 will be collected from the backfilled trench such that these are fairly uniformly distributed along the length of the slurry wall. Each sample shall be approximately 20 lbs (two ten lb bags). Mark one bag at each location "spare".
2. Samples P1 through P4 will be collected in Shelby tubes at approximate spacing of 400 feet along the length of the wall. At each location collect two tubes and mark one "spare".
3. Soil samples shall be sent to the Foth & Van Dyke soils laboratory.
4. Location of samples shall be determined by the resident engineer and shall be marked accordingly.

DRAFT**2.5 Trench Excavation and Backfilling****2.5.1 Requirements**

1. The cutoff wall shall be a minimum of three feet wide.
2. The trench shall be excavated vertically.
3. The slurry wall shall be keyed a minimum of three feet into the natural impervious strata below the overburden soils at the site (clay-silty clay) with the additional provision that the bottom of the wall shall be no higher than elevation 718 feet above m.s.l.
4. Center to center horizontal distance between monitor wells and slurry wall will be at least ten feet.
5. Bentonite-water slurry will be maintained at a level not more than two feet below the top of the trench.
6. Placement of the backfill shall be made only after the resident engineer inspects, approves and measures the trench or a portion thereof.
7. The toe of the backfill shall not be less than 25 feet or more than 100 feet from the toe of the excavation.

2.5.2 Trench and Backfill Inspections

1. Inspect and record the verticality of the backhoe boom as often as necessary but always after the backhoe has been moved to a new position (Maximum permissible deviation is three percent).
2. Monitor and record the continuity of the trench by dragging a rigid probe along the trench bottom.

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3. Inspect and record the cleanliness of trench bottom (absence of any sediments) using a rigid rod.
4. Monitor and record the profile of the backfill slope using a calibrated rigid probe.

NOTE: The above data shall be recorded by the resident engineer.

2.5.3 Trench Measurement and Approval

1. When the backhoe operator informs that he has reached the impervious clay-silty strata, first ensure that the elevation of the trench bottom is at or below 721 feet.
2. Second, visually classify the soil cuttings from the trench bottom to ensure that the trench bottom is indeed the layer into which the wall is to be keyed. Collect a five-pound bag sample for transportation and storage at Foth & Van Dyke's laboratory.
3. Measure and record the elevations of the trench bottom at different points at spacings not exceeding ten feet.
4. After excavating the key and cleaning the trench bottom measure and record the elevations of the key bottom elevations.
5. Before and after the backfilling operations record the distance between the toe of the backfill and the toe of the excavation.

NOTE: The above data are to be recorded by the Resident Engineer.

DRAFT**2.6 Construction Photographs**

Resident engineer shall take photographs of all phases of construction. Each photo shall be properly labeled as follows:

1. Project Name
2. Date of Photo
3. Identity of Subject
4. Direction of View
5. Photo Number

2.7 Reports**2.7.1 Daily Reports**

The Resident Geotechnical Engineer shall complete a daily inspection report on the prescribed form, outlining all activities for that day. A copy of this report shall be submitted to BFI's on-site representative at the end of each day.

2.7.2 Final Report

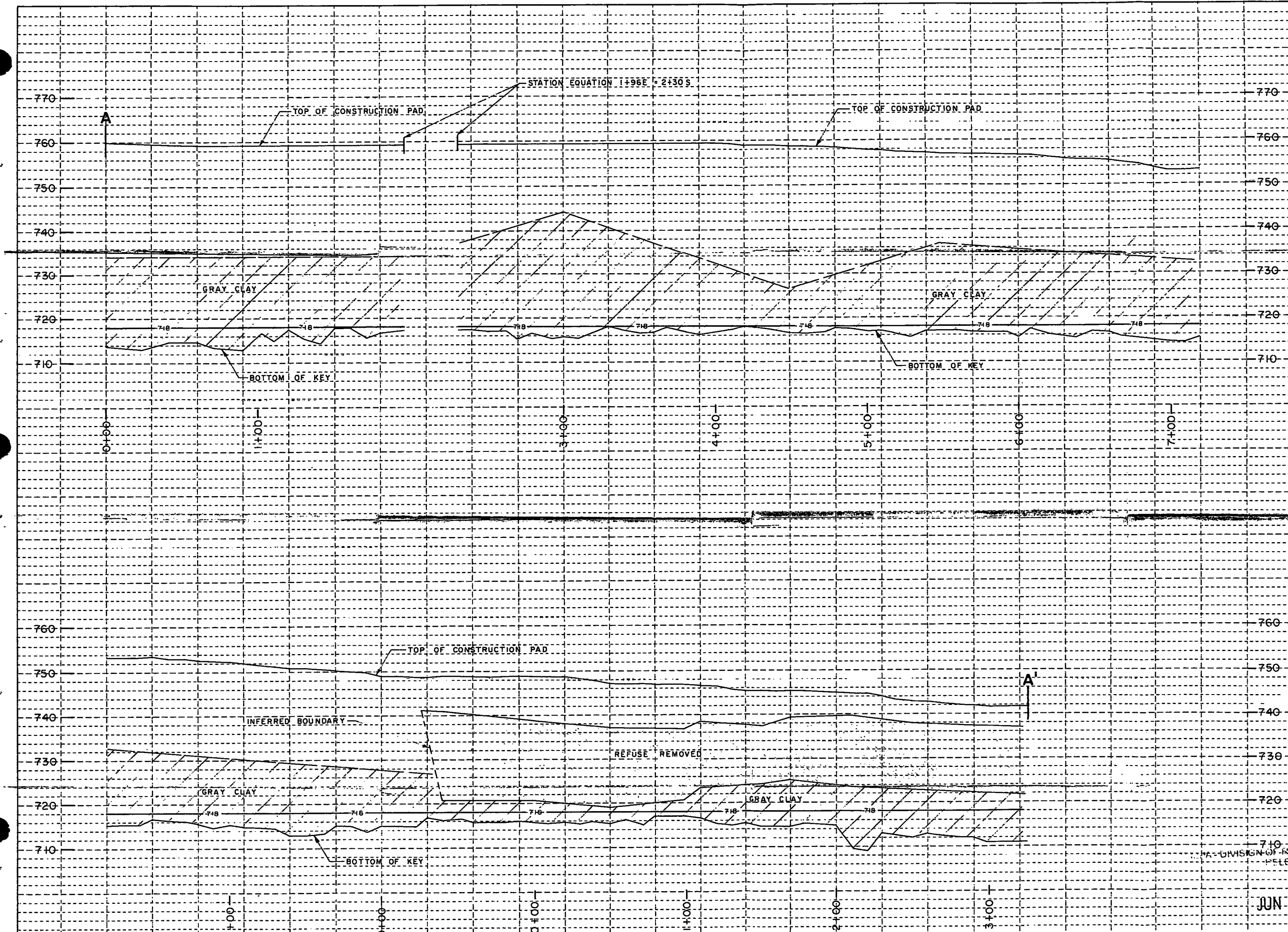
A final report documenting as-built conditions shall be submitted upon completion of the work. This report will be prepared by the Geotechnical Engineer and contain daily reports, all test data, and as-built construction plans.

Appendix C

DRAFT

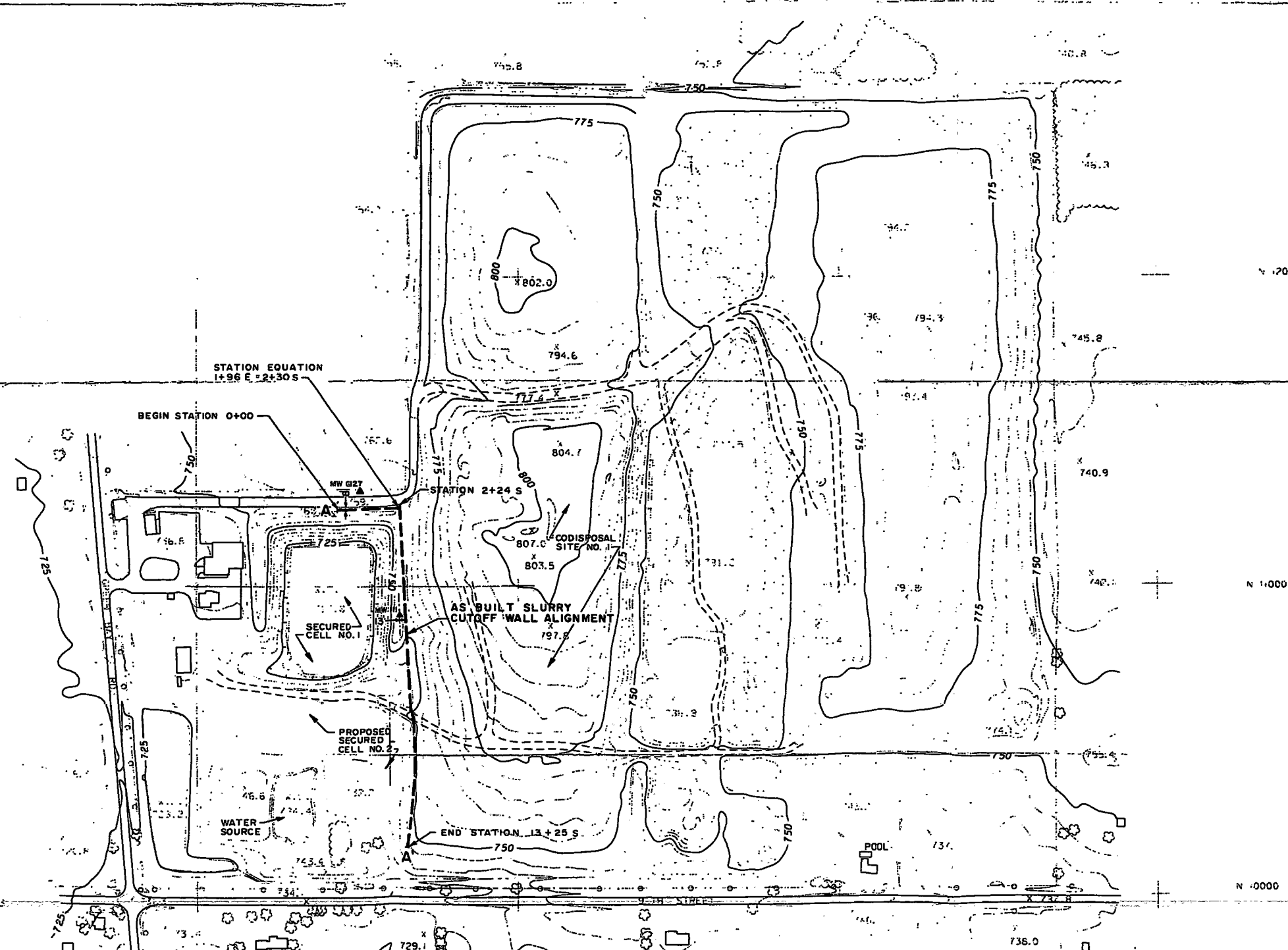
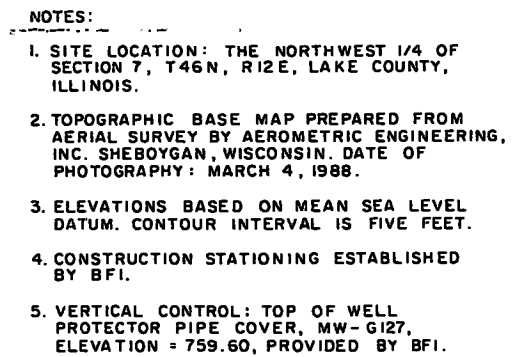
APPENDIX C

Record Drawing No. A-1 Cutoff Wall Location
Record Drawing No. A-2 Cutoff Wall Profile



SECTION MANAGER		
PROJECT ENGINEER		
DESIGN ENGINEER		
TECHNICAL ENGINEER		
RELEASES	DATE	BY:
ENGINEERING REVIEW		
SECTION MANAGER		
HYDRO.		
TECHNICAL ENGINEER		
RELEASES	DATE	BY:
HYDROGEOLOGIC REVIEW		
PROJECT REVIEW		
6		
5		
4		
3		
2		
1		
NO.	DATE	BY:
DESCRIPTION		
REVISIONS		
WASTE SYSTEMS™ BROWNING-FERRIS INDUSTRIES OF ILLINOIS, INC.		
WINTHROP HARBOR WASTE MANAGEMENT DOCUMENTATION	FACILITY LAN	ALL -A-
Foth & Van Dyke Geoscience & Environmental Management Division 2737 S. Ridge Road P.O. Box 1902 Green Bay, WI 54307-9002 414/497-2500		
DRAWN BY	S J L	
DATE	FEB. 1989	
BOOK NO.		
JOB NO.	88 B 59	
FILE NO.		
SURVEYED BY	T J A	

JUN 27 2025



Appendix D

DRAFT

APPENDIX D

Communication from BFI Regarding Design



DEC 29 1988

DRAFT

December 21, 1988

Mr. Nandu Paruvakat
2737 S. Ridge Road
P.O. Box 19012
Green Bay, WI 54307-9012

Dear Mr. Paruvakat:

Enclosed are the grain size distribution results for the backfill mix to be used in the slurry trench cutoff wall being constructed at BFI's Winthrop Harbor facility.

If you have any question or comments, please contact me.

Sincerely,

A handwritten signature in cursive script that reads 'Mike Williams'.

Mike Williams
Assistant Regional Landfill Manager

BROWNING-FERRIS INDUSTRIES
of ILLINOIS, INC.

MWW/rh
Enclosure

DRAFT

STS CONSULTANTS, LTD.

GRAIN SIZE DISTRIBUTION (ASTM D 422)

Project : BFI
 Boring/Source: Boring 3, Combined with 20% Barrow
 Sample Number: #2 Material, 1% Bentonite Added and
 Depth (feet): Enough Slurry to Obtain 4-6in. Slump
 USCS Classification: (CL)
 Soil Description : SILTY CLAY, SOME F TO C SAND, TRACE F GRAVEL-
 BROWNISH GRAY

STS Job No.: 17590-XH
 Date : 12-20-88
 LL: - PL: - PI: -
 WC: - SP.GR.: 2.76 Est

SIEVE ANALYSIS --

SAMPLE WEIGHT: 66.71 GRAMS

SIEVE SIZE	WEIGHT RETAINED	PER CENT RETAINED	PER CENT PASSING
.50"	0.00	0.00	100.00
.375"	3.25	4.87	95.13
#4	3.39	5.08	90.05
#10	2.13	3.19	86.85
#20	2.27	3.40	83.45
#40	2.17	3.25	80.20
#60	2.47	3.70	76.50
#100	2.86	4.29	72.21
#200	2.20	3.30	68.91

HYDROMETER ANALYSIS --

HYDROMETER SAMPLE WEIGHT: 51.77 GRAMS

ELAPSED TIME	TEMPERATURE CENTIGRADE	ACTUAL READING	ADJUST READING	GRAIN SIZE	PER CENT FINER
0.25	23.0	47.00	42.00	0.0748	68.84
0.50	23.0	46.00	41.00	0.0534	67.20
1.00	23.0	45.00	40.00	0.0381	65.56
2.00	23.0	43.50	38.50	0.0273	63.10
5.00	23.0	41.00	36.00	0.0176	59.01
15.00	23.0	35.00	30.00	0.0107	49.17
30.00	23.0	31.50	26.50	0.0078	43.43
60.00	23.0	28.50	23.50	0.0056	38.52
120.00	23.0	26.00	21.00	0.0040	34.42
1105.00	23.0	21.00	16.00	0.0014	26.22



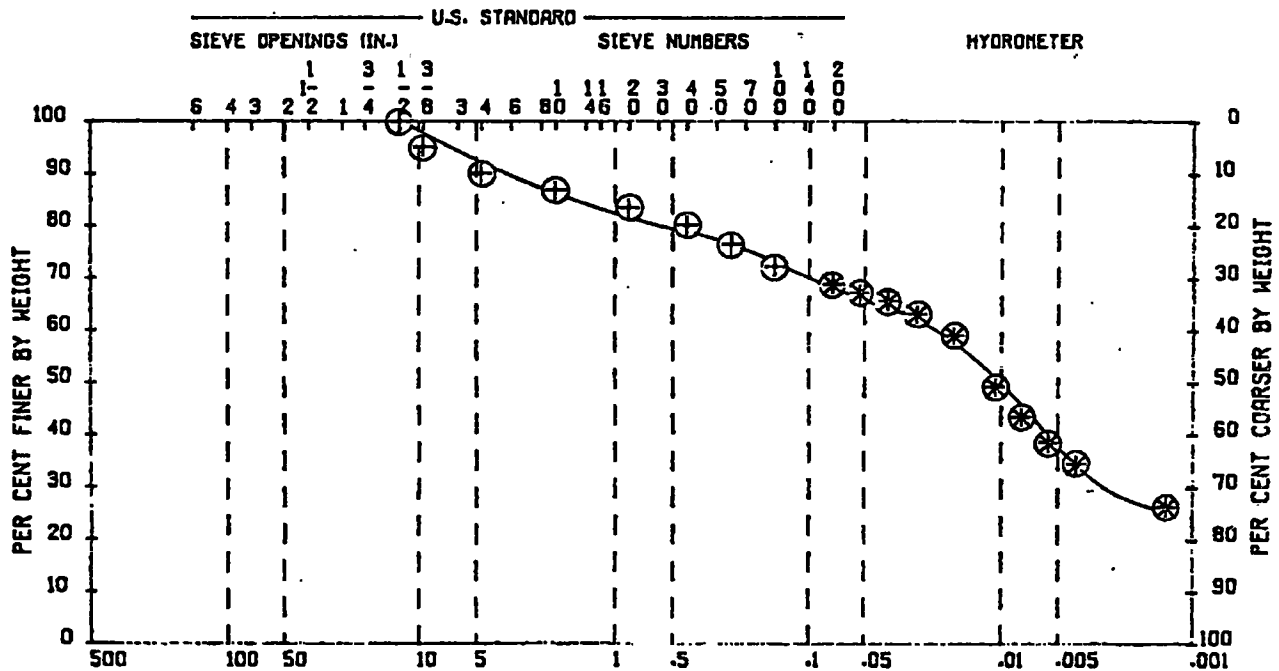
STS Consultants Ltd.

GRAIN SIZE DISTRIBUTION (ASTM D 422)

DRAFT

PROJECT : BFI
 BORING/SOURCE: Boring 3, Combined with 20% Barrow #2
 SAMPLE NUMBER: Material, 1% Bentonite, and Enough
 DEPTH (FEET): Slurry Added to Obtain 4-6in. Slump
 USCS CLASSIFICATION: (CL)
 SOIL DESCRIPTION : SILTY CLAY, SOME F TO C SAND, TRACE F GRAVEL - BROWNISH GRAY

STS JOB NO. : 17590-XH
 DATE : 12-20-88
 LL: - PL: - PI: -
 WC: - SP.GR. : 2.76 EST.



GRAIN SIZE IN MILLIMETERS

COBBLES	GRAVEL			SAND			SILT OR CLAY
	CO	MED	FINE	CO	MEDIUM	FINE	

DRAFT

APPENDIX E

Photo Documentation

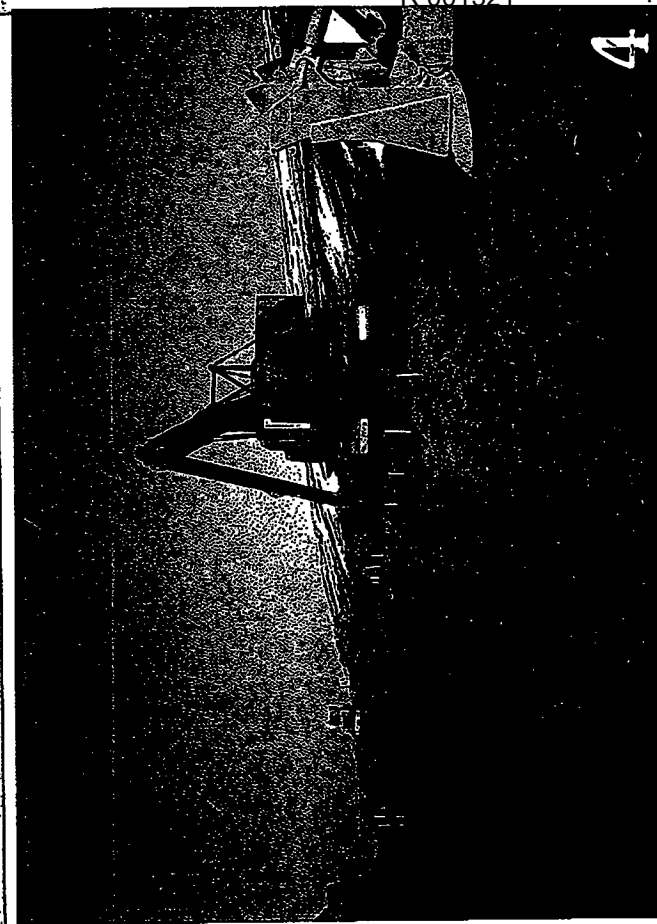
DRAFT**LIST OF PHOTOS**

<u>Photo No.</u>	<u>Photo Descriptions</u>
1	Box used to mix dry bentonite with fresh water under high pressure prior to being pumped to holding pond. December 1988.
2	View of construction work pad with backhoe in operation. Looking west with machine at station 1+00E. December 1988.
3	A three foot level mounted on backhoe's counter weight. To verify verticality of slurry cutoff wall. Checked after each movement of backhoe. December 1988.
4	Backhoe on construction pad with ten foot offset markers. Looking north (approximate) station 8+00S. December 1988.
5	Backfill profile being checked from station 3+80S to station 5+60S. Looking south from (approximate) station 4+00S. December 1988.
6	Pumped slurry from holding pond being discharged into the trench at station 0+00E. Looking east. December 1988.
7	Backhoe at station 3+00S moving southward. Slurry level at approximately two feet from top of construction pad. Note: the turn of the trench at station 1+96E. December 1988.

DRAFT

- 8 Trench filled with slurry. Looking north from (approximate) 7+00S. Note: the excavated material placed away from face of trench. December 1988.
- 9 D6 Cat Dozer mixing backfill material. Excavated material, dry bentonite, clay from Borrow No. 2, and fresh slurry are mixed on pad. Looking northwest (approximate) station 3+50S. December 1988.
- 10 D6 Cat Dozer pushing mixed backfill into trench from the "daylight" of backfill. Looking north from (approximate) station 6+00S. December 1988.
- 11 Corner of trench at station 1+96E which equals 2+30S. The view of the six foot overlap (northend of project) looking south. December 1988.
- 12 Top of trench cave-in from station 0+00E to station 0+60E. Contractor re-excavated area to remove frozen material. Looking to the east. December 1988.

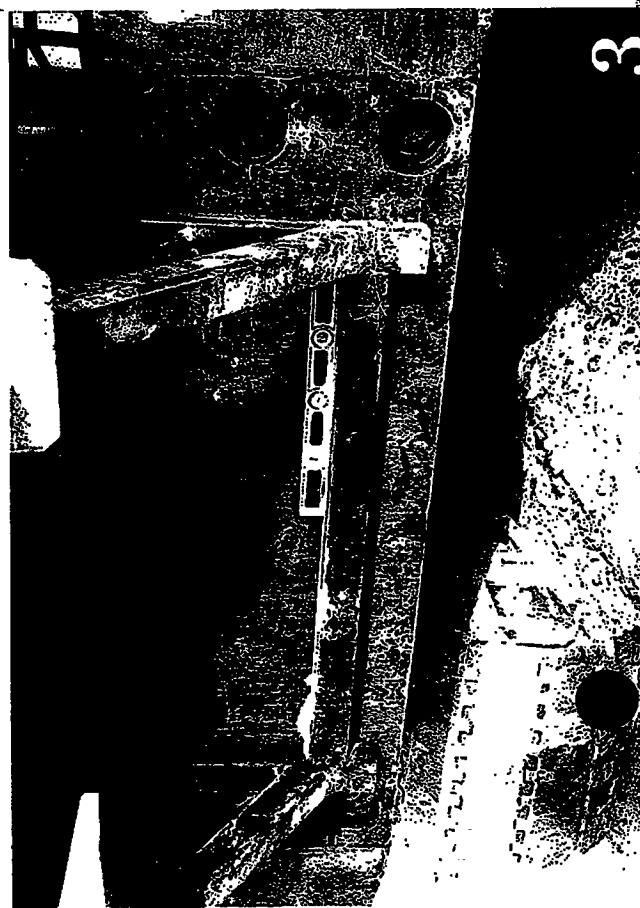
4



2

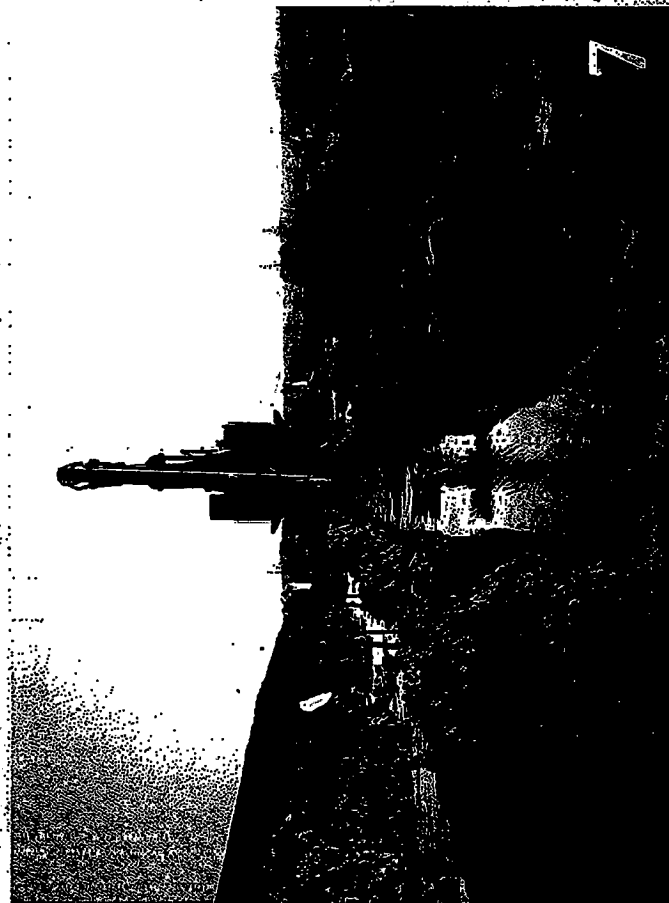
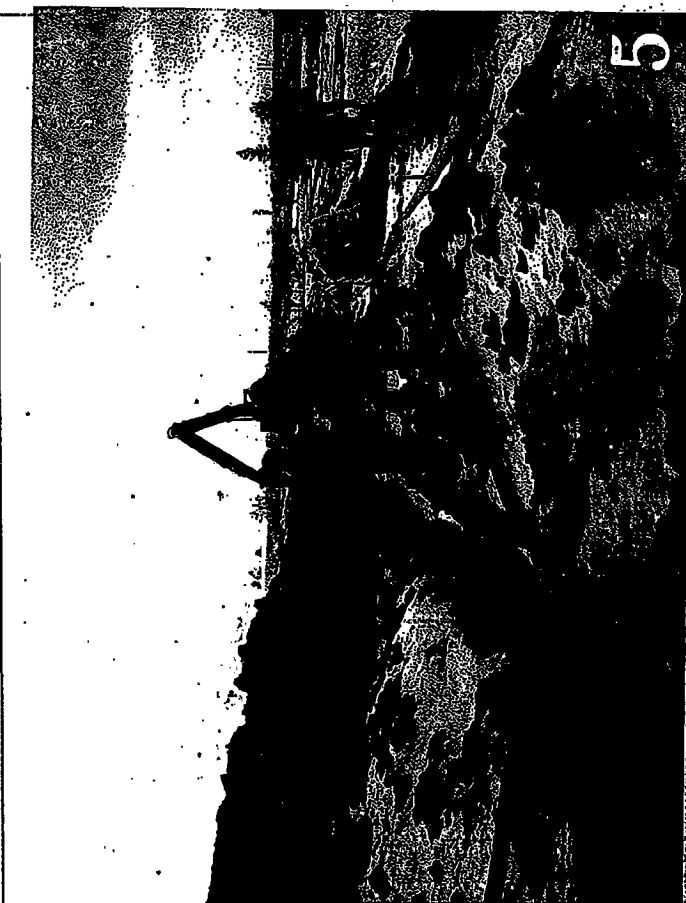
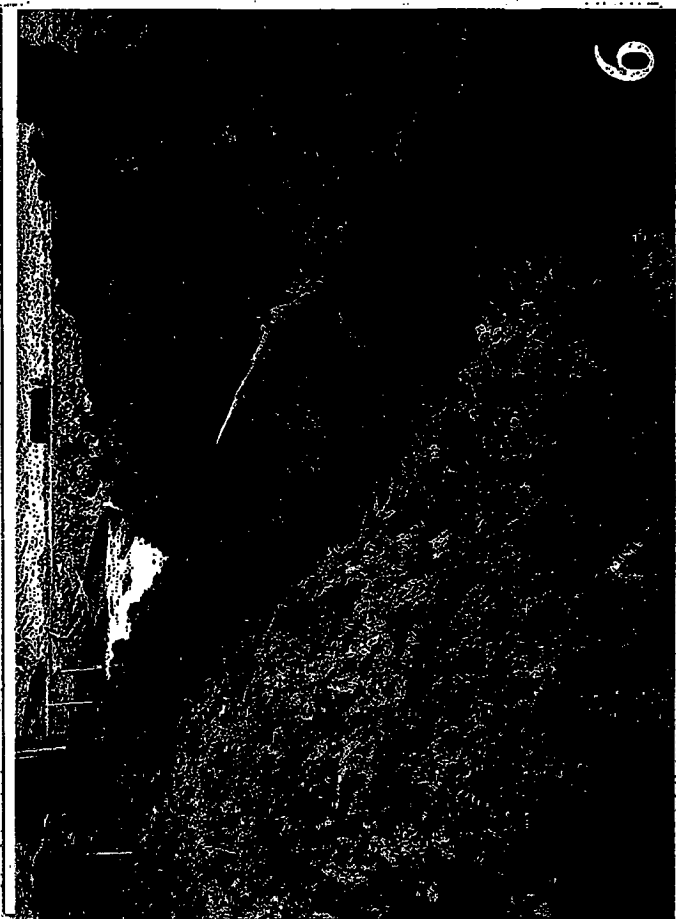


3



1





C-LINE #52584
35MM PRINTS



9



10



11



12

DRAFT

APPENDIX F

Resident Inspection Reports

Foth & Van Dyke

RESIDENT INSPECTION REPORT

FORM #

172 PM

DATE REVISED

6-15-84

DATE

DECEMBER 15, 1988

THURSDAY

Job No. 881359

Contract _____

Owner BFI OF ILLINOIS Project SLURRY WALL CONSTRUCTIONProject Location WINTHROP HARBORReport No. 1Weather WINDY + COLD wind chill -15°FRain ☐ Snow ☐ Temp 15°Contractor CASE INTERNATIONALSuperintendent SUE BeckwithROSELLE, ILLINOISForeman LARRY TOLD

Work Completed ARRIVED ON SITE AT 7:30 AND MET BILL Parenteau
SITE MANAGER OF LANDFILL SITE. WE BOTH ARRIVED OVER TO
CHECK OUT SUE SCHEDULE SHE FELT THEY WOULD BEGIN DAY
DIGGING BY NOON. CASE SET UP MIXING PIT AT WATER
LOCATION DIGGING HOLE WITH 1066 HOEHOING. CONTRACTOR
PUT TOGETHER SLURRY LINES FROM SLURRY POND TO STATION 0100
MIKE WILLIAMS OF BFI ON SITE. HE INFORMED ME THAT THE
WALL SHALL BE MOVED CLOSER TO THE SECURED CANS AND BE
12' EAST OF MONITORING WELLS AND THEN WILL ANGLE BACK TOWARD
THE WEST AWAY FROM THE COMBINED FBI CRAWL
ILL #1. NANO OF FVUS ON SITE AT PAGE 1-4

Items of Interest (Include methods of installation, bracing, sheeting, dewatering, blasting, etc.) 10:00 WE EXPLAINED THE ALIGNMENT OF WALL AND

BEGAN TO STAKE AN OFFSET LINE. WE MARKED LOCATIONS OF
WHERE WALLS END AND BENDS ARE AND BEGAN STAKING
MIKE AND MYSELF PLACE AN ELEVATION EVERY 200'.

(Delays HOEHOING 1066 BLEW AN OIL LINE)

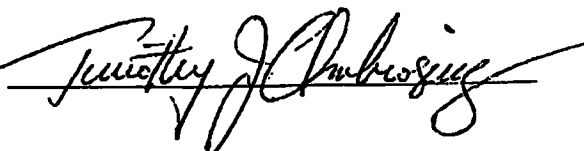
Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.)

DUE →

Required Testing Performed (By Inspector/Others)

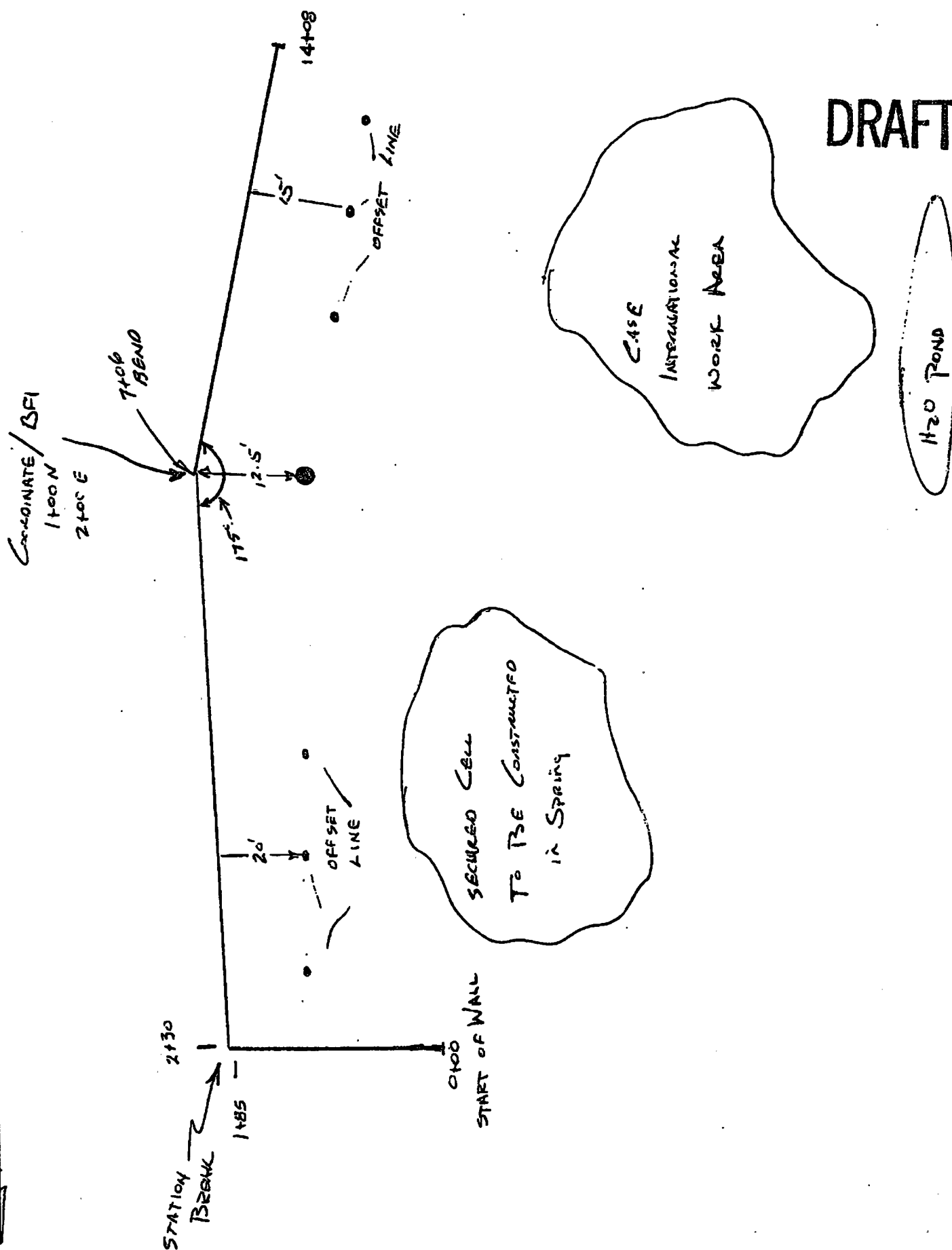
Visitors

Signed



DRAFT

North



50th & Van Dyke

RESIDENT INSPECTION REPORT

FORM #

172 PM

DATE REVISED

6-15-84

DATE

DECEMBER 16, 1988

Job No. 88B59

Contract

FRIDAY

Owner BFI OF ILLINOISProject SEURY WALL CONSTRUCTIONProject Location WINTHROP HARBORReport No. 2

DRAFT

Weather VERY COLD -17° WindchillRain ☐ Snow ☐ Temp 0°Contractor CASE INTERNATIONALSuperintendent SAE BRECKENRIDGEROSELLE, ILLINOISForeman LOTTIE TOLD

Work Completed

ACTUAL DIGGING OF TRENCH WALL ISN'T GOING TO START UNTIL TOMORROW. FROM SHOOTING STAKE ELEVATIONS WE WERE ABLE TO DETERMINE WHEN / HOW DEEP TO DIG WALL ALL LOCATIONS WERE DETERMINED. THE DEPTH WERE BASICALLY STARTING FROM 2+30 SOUTHWARD TO 14+08 HAVING A STARTING DEPTH OF ALITTLE MORE THAN 40'. I QUESTIONED THE 718 ELEVATION ACCORDING TO SPEC THE BOTTOM OF THE WALL MUST BE AT OR BELOW.

TALKED WITH MIKE WILLIAMS ABOUT SAMPLING. THE PROJECT IT SELF IS BASICALLY SHORTEN UP INSTEAD OF THE FULL 2700'. Our FBI PAGE 5-7
 TING PROGRAM HAS BEEN SHORTENED TO INCLUDE

Items of Interest (Include methods of installation, bracing, sheeting, dewatering, blasting, etc.) 20 AMBERBERG AND GRAIN SIZES WITH 5 PERMS TESTS.
WITH MIKE AND MYSELF WE WOULD CUT THE SAMPLING DOWN TO 12 GRAIN SIZES WITH 4 PERMS. ON THE 1400' OF WALL TO BE CONSTRUCTED. BFI WAS ASKED TO EXTEND THE PAD ON

Delays THE NORTH END OF THE PROJECT FROM STATION 0+00 TO STA. 1+90. BFI WILL DO THIS IN THE EARLY MORNING ON SATURDAY.
CASE DECIDED THAT TO START DIGGING ON WALL AT 3:00 WAS NOT

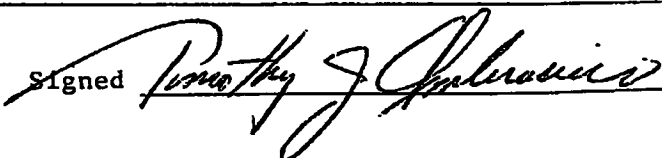
Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.) FEASIBLE SO THEY OPT TO REPAIR A BROKEN CABLE ON THE CRANE COUNTER WEIGHT TOWER. MIKE CALLED AND INFORMED ME OF CORNER OF WALL THAT WHEN CASE BEGINS SOUTH THEY GO PAST THE WALL TO ENSURE THAT A GOOD JOINT IS BEING OBTAINED

Required Testing Performed (By Inspector/Others)

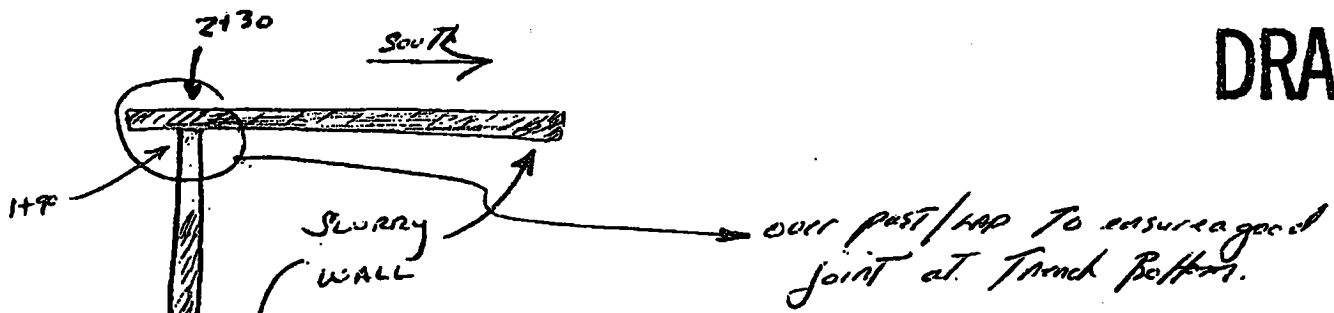
OVER →

Visitors

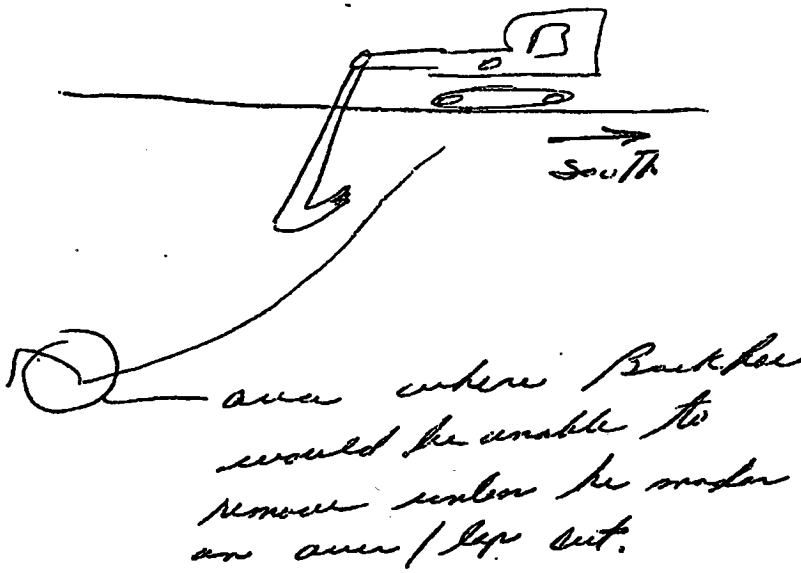
Signed



DRAFT



NOTE: IF WE DON'T DIG PAST THE wall we will have Trench spoil on Bottom which Backhoe will not be able to remove



RESIDENT INSPECTION REPORT

Booth & Van Dyke

FORM #

172 PM

DATE REVISED

6-15-84

DATE

DECEMBER 17, 1988

Job No. 88859

Contract

SATURDAY

Owner BFI OF ILLINOIS

Project SLURRY WALL CONSTRUCTION

Project Location WINTHROP HARBOR

Report No. 3

DRAFT

Weather Sunny/Windy Cold Wind Chill -15°

Rain ☐ Snow ☐ Temp TEENS

Contractor CASE INTERNATIONAL

Superintendent Sam Backlund

ROSELLE, ILLINOIS

Foreman JAMES TACKER

Work Completed

FB 1 PAGES 8-10

BFI BEGAN TO CONSTRUCT A LEVEL BASE PAD ALONG THE NORTH END OF SLURRY WALL CONSTRUCTION IE STA. 0100 TO 1490. BFI USING 2-CAT SCRAPPERS TO MULIN CLAY FROM BELOW. CASE INTERNATIONAL BEGAN ACTUAL DIGGING FOR SLURRY WALL CONSTRUCTION. THEY STARTED CUTTING A CLAY IN TRENCH 65'-70' WEST OF STATION 0100 (SEE BACK). CASE BEGAN PUMPING SLURRY INTO HEAD-IN TRENCH WHEN DEPTH OF 8' WAS REACH THE SLURRY WAS PUMPED THRU THE ENTIRE DAY. BACKLINE CONTINUED TO BE DURING PUMPING OPERATION. MEASURED WIDTH OF THE TRENCH FROM TIP OF TOOTH TO TIP OF TOOTH AS WELL AS THE

Items of Interest (include methods of installation, bracing, sheeting, dewatering, blasting, etc.), TRENCH IT'S SELF AND IT WAS 3' VERTICAL

CHANGING OF WALL IS DONE BY PLACING A LEVEL ON BACKLINE FRAME (COUNTER WEIGHT) THE LEVEL IS LEFT IN PLACE AND CHECKED WHEN MACHINE IS MOVED. ENDED DAY AT STATION

Delays 0150 FOR DAY.

Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.) BACK FILL PROCESS NOT STARTED

Required Testing Performed (By Inspector/Others) 300g SAMPLES OF KEY IN MAT'1 WERE OBTAINED AT STATION 0100. SLURRY MIX WAS ALSO TESTED. (OVER.)

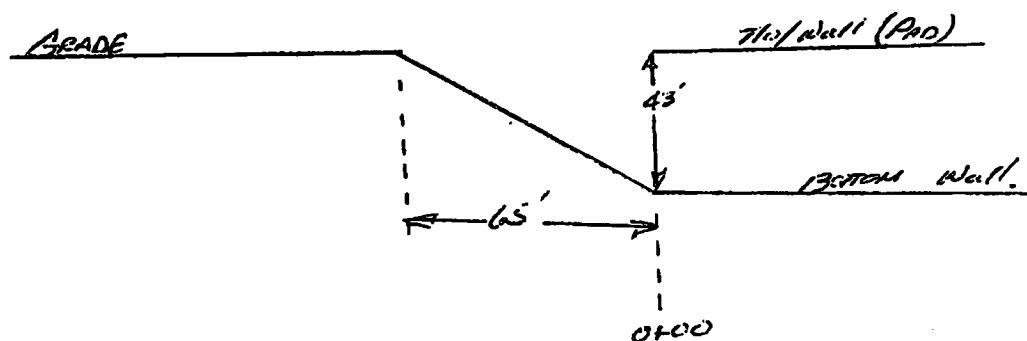
Visitors John DIXON - BFI

Signed

Timothy J. Anderson

LEAD-IN TRENCH

DRAFT



TESTING / Sampling

BACKFILL - NONE

SLURRY = AT TRENCH

STA.	Funnel	BALANCE	PRESS	FAIL
Initial	37	66	20.5	
OTL				

IMPROVED SOLE THAT
SLURRY WASN'T TO SPEC &
THAT MORE BENTONITE MUST
ADDED IE MAKE STRONGER.

SOLE START DIGGING
PROCESS DOWN AT 3:30 due
TO NOT HAVING SLURRY
MIXED WILL START w/
STRONGER BATCH in A.M.

RESIDENT INSPECTION REPORT

Booth & Van Dyke

FORM #

172 PM

DATE REVISED

6-15-84

DATE

DECEMBER 18, 1988

Job No. B8B59

Contract _____

Owner BFI OF ILLINOISProject SLURRY WALL CONSTRUCTION

DRAFT

Project Location WINTHROP HARBORReport No. 4Weather OVERCAST - WINDY - COLDRain ☐ Snow ☒ Temp TEENSContractor CASE INTERNATIONALSuperintendent SUE BRECKENRIDGEROSELLE, ILLINOISForeman LA MAR TODD

Work Completed _____

FB 1 PAGE 11-18

CONTRACTOR BEGAN EXCAVATION OF TRENCH MOVING EAST FROM STATION 0+50 AND FINISHED DIGGING AT STATION 1+10. A NEW BATCH OF SLURRY WAS MIXED AND PUMPED INTO HOLDING POND. THIS MIXING OF SLURRY WAS WELL MORE THAN THE 4% WHICH WAS REQUIRED DUE TO THE FIRST BATCH MIX BEING A SLIGHT BIT LIGHT. TRENCH DEPTH EQUIPMENT WAS MEASURED USING A WEIGHTED 1- 1066 KOENIG BACKHOE TAPE MEASURED EVERY 10'. THE TOP OF 1- RUBBER TIRE CHAIR PICKER PAD WAS SHOT ON 10' INTERVAL PRIOR TO D6 CAT DOZER CONSTRUCTION. VERTICALITY OF WALL WAS CHECKED BY HAVING LEVEL MARKED ON GEN/SETS WAS CHECKED BY HAVING LEVEL MARKED ON 5' MEN 3 WOMEN COUNTERWEIGHT.

Items of Interest (Include methods of installation, bracing, sheeting, dewatering,

blasting, etc.) SLURRY IN TRENCH WAS ±2' BELOW TOP OF PADAT ALL TIMES DURING DAY

Delays _____

Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.)

THE BACKFILLING OPERATION DIDN'T START DUE TO FACT THAT DISTANCE OF TRENCH WASN'T FAR ENOUGH ALONG TO BEGIN.

Required Testing Performed (By Inspector/Others) RAN TESTS ON SLURRY WHERE

SAMPLES WERE OBTAINED FROM THE TOP OF TRENCH AND ALSO - HOLDING POND. ALL TESTS RAN WERE OK.

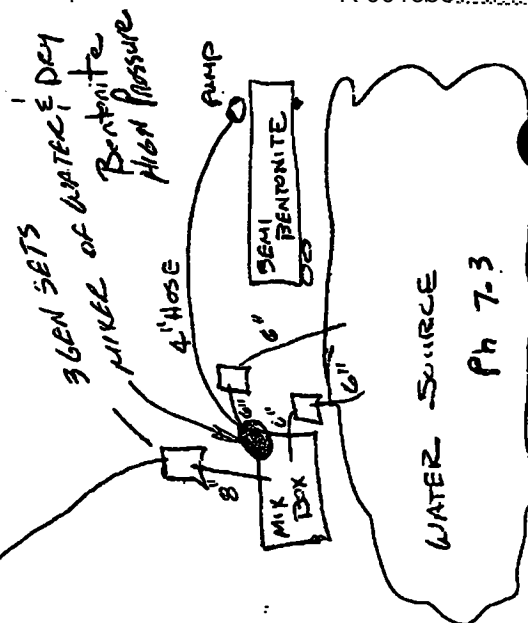
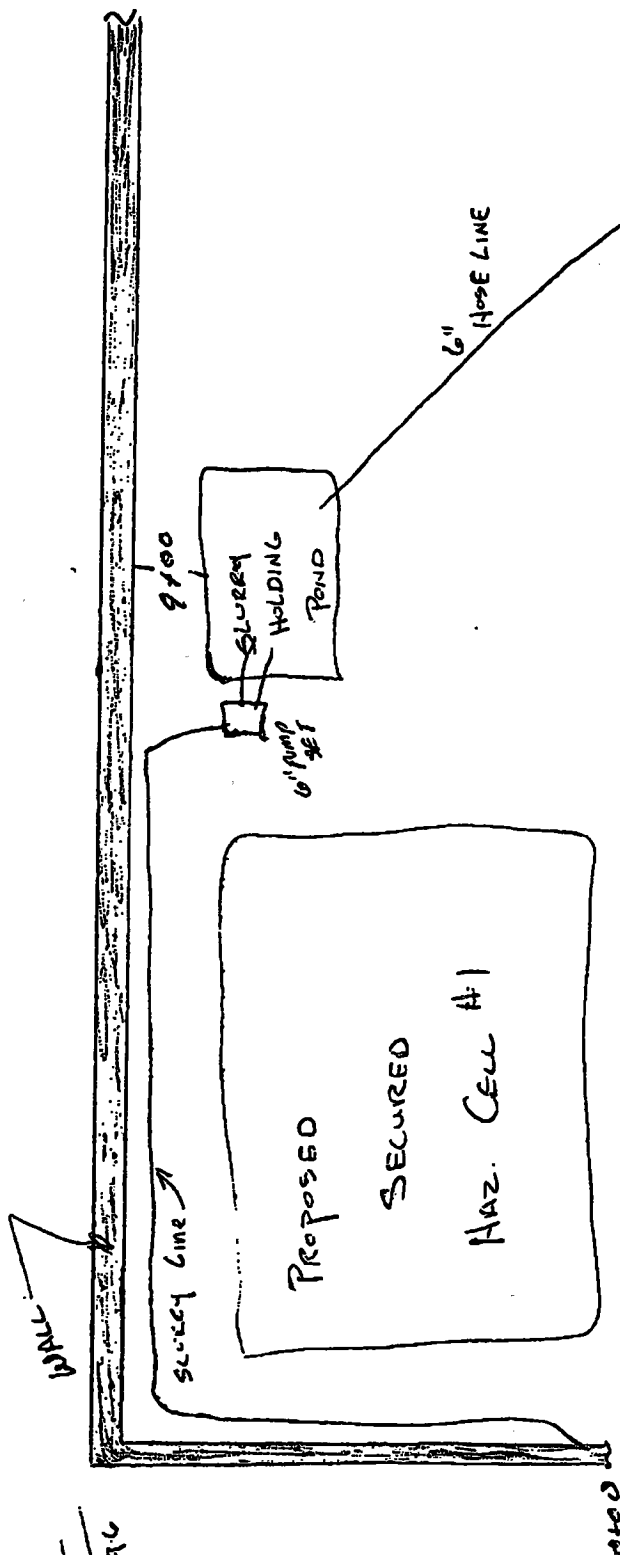
Visitors _____

Signed

Timothy J. Sullivan

SLURRY SET UP

Co-Disposal Cell



DRAFT

~~ABETH~~

2x24
1796

RESIDENT INSPECTION REPORT

Booth & Van Dyke

FORM #

172 PM

DATE REVISED

6-15-84

DATE

DECEMBER 19, 1988

Job No. 88B59

Contract

Owner BFI OF ILLINOIS Project SLURRY WALL CONSTRUCTION

Project Location WINTHROP HARBOR

Report No. 5

Weather SUNNY - SOUTH WIND

Rain ☐ Snow ☐ Temp 40°

Contractor CASE INTERNATIONAL
ROSELLE, ILLINOIS

Superintendent SUE BECKENRIDGE

Foreman LAMAR TODD

Work Completed

FB1 page 19 - 24

BEGAN TRENCHING USING 1066 BACKHOE MOVING EAST FROM
STATION 140 TO STATION 1430. SLURRY DEPTH WAS KEPT AT
± 2' FROM T/O PAD. VERTICALNESS OF TRENCH WAS CHECKED IN

HAVING LEVEL MOUNTED ON COUNTER WEIGHT

EQUIPMENT OF MACHINE. BOTTOM OF KEY IS CHECKED

1- 1066 REMOVING BACKHOE USING WEIGHTED TAPE AND IS CHECKED

1- AG CAT DOZER EVERY 10' FROM STATION 0400 TO 0460

4- GEN SETS TOP OF TRENCH CAVED IN. SUE WANTS TO

5 MEN 3 WOMEN. START BACKFILLING AND COME BACK LATER.

AND READING THIS 60'.

Items of Interest (Include methods of installation, bracing, sheeting, dewatering, blasting, etc.) SLURRY OF TRENCH IS PUMPED FROM HOLDING POND

TO TRENCH AND MAINTAINED AT A LEVEL OF ± 2' BELOW PAD

Delays 9:30 BACKHOE HIT ± 1' LAYER OF RIP RAP IN TRENCH

3' BELOW SURFACE OF PAD. BACKHOE SLIPPED OFF PADDED MACHINE AND
BROKE THE COUNTERWEIGHTS OFF MACHINE DOWN REST OF DAY.

Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.) BACKFILL OPERATION DIDN'T START

Required Testing Performed (By Inspector/Others) Slurry Samples were pulled
Both the Trench and at the pond. TESTS WERE OK

Visitors

Signed

Timothy J. Ambrosini

RESIDENT INSPECTION REPORT

Foth & Van Dyke

FORM #

172 PM

DATE REVISED

6-15-84

DATE

DECEMBER 24, 1988

Job No. 88B59

Contract _____

Owner BFI OF ILLINOIS

Project

Slurry Wall ConstructionProject Location Winthrop HarborReport No. 6Weather Overcast - Windy Gusts of 20 mphRain ☐ Snow ☐ Temp 30°Contractor CASE INTERNATIONALSuperintendent Sue Ben KenridgeROSELLE, ILLINOISForeman LAMAR TEAN

Work Completed _____

FB 1 page 25SITE VERY WET FROM RAINFELL THROUGH NIGHT. CASE WASUNABLE TO DO ANY CONSTRUCTIONDO TO REPAIRING THE COUNTERWEIGHTSON BACK MCH. DOWN FOR ENTIRE DAY.

Items of Interest (Include methods of installation, bracing, sheeting, dewatering, blasting, etc.) _____

Delays _____

Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.) _____

Required Testing Performed (By Inspector/Others) _____

Visitors _____

Signed

Timothy J. Ambrosio**DRAFT**

Booth & Van Dyke

RESIDENT INSPECTION REPORT

FORM #

172 PM

DATE REVISED

6-15-84

DATE

DECEMBER 21, 1988

Job No. 88B59

Contract

Owner BFI of Illinois Project Slurry Wall ConstructionProject Location WINTHROP HARBORReport No. 7Weather SLIGHT WIND - Nice DayRain ☐ Snow ☐ Temp 20°Contractor CASE INTERNATIONALSuperintendent Sue BreckinridgeROSELLE, ILLINOISForeman LAMAR TOM

Work Completed

FB 1 PAGE 26 - 32

CASE BEGAN CONSTRUCTION OF TRENCH DIGGING AT STATION 1140 MOVING EASTWARD. CASE MADE IT TO CORNER OF THE WALL.

WALKED BACKWARDS AROUND SOUTH THAT THEY COULD BEGIN DIGGING IN THE SOUTH DIRECTION. Trench depth is measured every

EQUIPMENT 10' FROM TOP OF PAD TO BOTTOM OF

1 - HOISTING 1066 Backhoe KEY. THIS DEPTH IS RECORDED. CASE

1 - CAT 90 DOZER MADE AN OVERLAND CUT IN MAKING CORNER

1 - LOADER (SEE BACK) - POSITION OF WALL WAS

MAN + WOMAN (5/3) checked using the 3' level which was mounted on Backhoes counterweight

Items of Interest (Include methods of installation, bracing, sheeting, dewatering, blasting, etc.)

Slurry Backfill was being mixed using the 90 Cat Dozer. The Backfill was excavated material mixed w/ slurry pumped out of the trench and slurry at 4'6 Backhoe and mixing Dry Bentonite added too. (BT and my self STAFF)

Delays And sheet E of trench to E150. Slurry depth was maintained @ 2' below top of construction pad. Backfill operation finished @ 0175 for clay.

Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.)

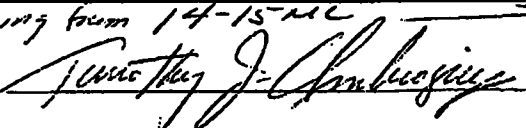
Backfilling operation started (USE WANTED TO FILL AREA WHERE CRACK - IN HAPPENED (0100 TO 0140) THEY JUST FILLED DUE TO FACT THAT THEY WOULD HAVE TO RE-DO THIS LENGTH.

Required Testing Performed (By Inspector/Others)

Tests were run on the Slurry - Backfill - and the Slurry mixed in pond. The funnel test results of 40 to 45 seconds, Balance of 64.5 to 67 and Press

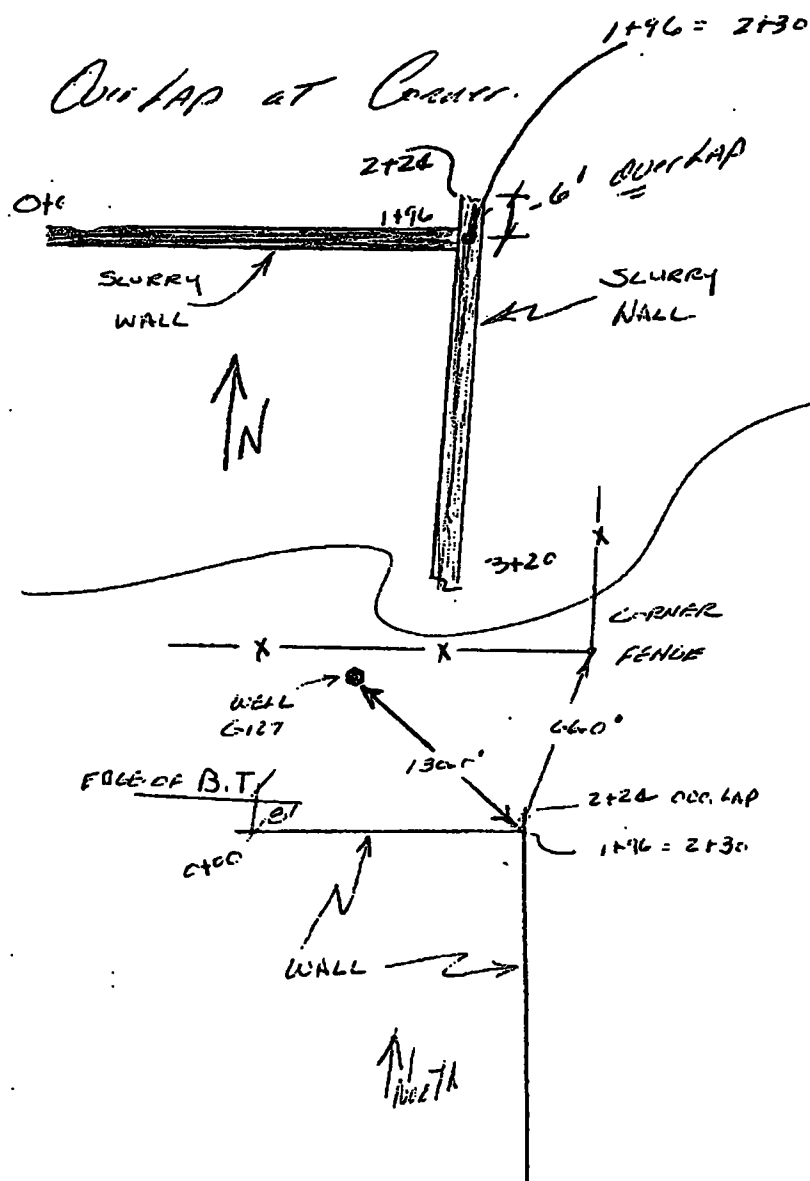
Visitors 2 - Teachers of HHS.

Signed

Ranging from 14-15 sec


DRAFT

Overlap at Corner.



- THE OVERLAP ENSURES THAT CORNER IS CLEAN. I TOOK TAPE AND MEASURED AROUND CORNER - MAKING SURE IT WAS CLEARED OUT.

DRAFT

CORNER TIES

TESTING.

LOCATION	Funnel	Balance	Press	TEMP
pond	40	65.0	14.0	50°F
pond	41	65.5	14.0	50°F
pond	41	65.0	14.0	50°F
pond	40	64.5	14.5	50°F
2+50. 1/2 ft trench	45	67.0	15.0	51°F
40 "	40	65.0	14.5	51°F
2+50 7 1/2 ft trench	40	67.0	15.0	51°F
1+90	40	66.0	14.0	51°F

Foth & Van Dyke

RESIDENT INSPECTION REPORT

FORM #

172 PM

DATE REVISED

6-15-84

DATE

DECEMBER 22, 1988

Job No. 891359

Contract

Owner BFI of IllinoisProject Slurry Wall Construction**DRAFT**Project Location Winthrop HarborReport No. BWeather Cold - Cloudy - Windchill 0°FRain ☐ Snow ☐ Temp Low 20'sContractor CASE INTERNATIONALSuperintendent Sue BeckenridgeROSELLE, ILLINOISForeman KAMAR ToddWork Completed FB 1 PAGE 33 - 41

CASE BEGAN WALL Trenching @ STATION 3+20 moving Southward TO STATION 3+60. Backfilling operation starting @ 0115 on North wall. BFI had their SURVEYORS on site to locate the BULKHEAD LINE which are to be the centers of Secured Cases #1, #2.

EQUIPMENT CASE & MYSELF SHOT CONSTRUCTION every 10' such that
 1- 1066 HERRING BACKHOE | WE COULD MEASURE DEPTH OF KEY.
 1- D6 CAT DOZER | WITH PAD BEING CUT AT 2.0% we needed
 1- RUBBER TIRE LOADER | TO HAVE A BETTER CONTROL FOR KEY. Therefore we
 1- PUMP SETS | Shot every 10'
 5 MEN GUARD

Items of Interest (Include methods of installation, bracing, sheeting, dewatering, blasting, etc.)

Delays Backhoe down @ 3830 and station 3+60 with hydraulic hose
Line Leaking

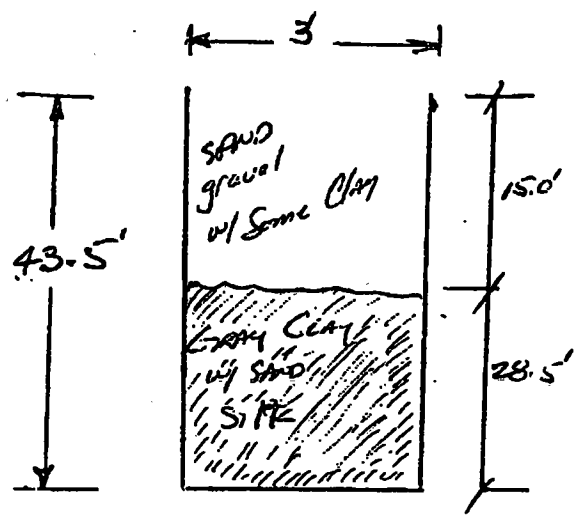
Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.) Backfilling operation @ 0115 of north wall. The Digger with the RUBBER TIRE loader is taking mat'l from excavation pumping slurry from Trench into it then adding dry Bentonite and mixing ALL TOGETHER BY DRIVING DOZER THROUGH IT. It is pushed at
Required Testing Performed (By Inspector/Others) high end and allowed to "flow" into excavated Trench gradually.

Visitors BFI SURVEYORS

Signed

Anthony J. Shlosberg

Soil Conditions Prior To Construction 3+00



Testing was done throughout entire day
on both Slurry & Backfill.

At pond no tests were done
due to fact NOTHING was MIXED.

TH/Trench	Funnel	Balance	Temp	Press
3+50	53	70	49	14.5
2+50	57	69	49	14.5

Blot/Trench	Funnel	Balance	Temp	Press
3+50	49	68	46	14.0
2+50	46	67	46	14.5

Backfill Generation

1+00 P-200 = 76.2 4" Slump 40°F
117 15/FT³ NET DENSITY.

Key-In Samples OBTAINED @

3+50 1 BAG

Backfill Samps @ 1+96/2+30

DRAFT

Booth & Van Dyke

RESIDENT INSPECTION REPORT

FORM #

172 PM

DATE REVISED

6-15-84

DATE

December 23, 1988

Job No. 881359

Contract

Owner BFI OF ILLINOIS Project Slurry Wall ConstructionProject Location Winthrop HarborReport No. 9Weather Very Windy - Gusts of 40 mph.Rain ☐ Snow ☐ Temp 20 inContractor CASE INTERNATIONAL
ROSELLE, ILLINOISSuperintendent Sue BrakenridgeForeman Lamar Todd

DRAFT

Work Completed

FBI page #1-42

Contractors BEGAN DIGGING AT STATION 3+50 AND WAS TRENCHING SOUTH. A NEW BATCH OF SLURRY WAS MADE SUCH THAT THE LEVEL IN THE TRENCH COULD BE RAISED. VERTICALNESS OF THE TRENCH WAS CHECKED USING THE 3' LEVEL ROD ON COUNTER

Equipment WEIGHT. THE DEPTH OF TRENCH
 1- 1066 Hoeing Backhoe was measured using a WEIGHTED
 1- DG CAT DOREIR TAPE AND CHECKED EVERY 10'. THE
 1- Rubber Tire Loader PRO WAS SHOT EVERY 10' SO WE KNEW
 1- PUMP SETS THE DEPTH REQUIRED TO REACH THE 718.0
 1- MEN - 3 Women LINE.

Items of Interest (Include methods of installation, bracing, sheeting, dewatering, blasting, etc.) (SHOT DOWN EARLY FOR HOLIDAYS)

Delays

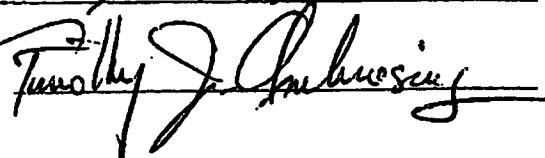
Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.)

BACKFILL OPERATION WAS CONTINUED WITH CONTRACTOR STARTING TO MIX A NEW BATCH OF BACKFILL. BACKFILL WAS EXISTING MAT'L WITH DRY BENTONITE BEING ADDED AT A RATE OF 4 TONS / 200 LINEAL FEET AND SLURRY FROM TRENCH

Required Testing Performed (By Inspector/Others) IS ORDERED TO ACHIEVE A 4"-6" SLUMP. BACKFILL IS THEN COVERED OVER TO HIGH END "AT LIGHT" AND ALLOWED TO EASE ITS WAY INTO TRENCH.

Visitors

Signed



DRAFT

TESTING

Time	Funnel	Balance	Temp	Press	
1190	47	69.5	43°	14.0	} Bottom of Trench
4100	46	68	44°	14.5	
1190	42	66	40°	13.5	} Top of Trench
4100	44	66	41°	13.0	

No Sampling from Pond. Only mixed by no pumping

Backfill Sampled @ 1100

AFT DENSITY = 120 lb/ft^3

Slump = 5"

P-200 = 75.3%

Booth & Van Dyke

RESIDENT INSPECTION REPORT

FORM #

172 PM

DATE REVISED

6-15-84

DATE

DECEMBER 27, 1988

Job No. 28859

Contract

DRAFTOwner BFI OF ILLINOIS

Project

Slurry Wall ConstructionProject Location Winthrop HarborReport No. 10Weather Wind - wet siteRain ☐ Snow ☒ Temp 20°Contractor CASE INTERNATIONAL
ROSELLE, ILLINOISSuperintendent Sue BeckenridgeForeman Lamar Todd

Work Completed

FB1 page 43-46

BEGAN DIGGING OF TRENCH AT 4+50 moving Southward on wall. Backfilling operation proceeding and have REFINED THE CORNER (1496/2130). VERTICAL OF WALL is checked after

machine movement By Level was
Equipment mounted on the Counter weight.

1-1066 Kobelco Backhoe ENDED DAY AT Trenching @

1- D6 CAT DOZER STATION 5+30

4- PUMP SETS

1- LEADER

1- men 3 women.

Items of Interest (Include methods of installation, bracing, sheeting, dewatering, blasting, etc.)

Slurry is BEGINNING TO RUN OUT OF THE TRENCH TOP AT STATION 5+00 DUE TO A $\pm 2\%$ POS SLOPE ON THE NORTH/SOUTH WALL. DRY BENTONITE IS ADDED AT A RATE OF 4 TONS / 200' TO THE BACKFILL OF TRENCH. THE Slurry Clay/SILT Layer is

Delays MOVING DOWNWARD IF LESS THAN 15' BELOW POS. TOOK TAPE AND MEASURE BACKFILL SLOPE IT WAS CONSISTANT IN MOVING DOWNWARD FROM STATION 2+30 TO 5+00.

Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.)

Trench Backfilled with existing mat'l and is MIXED USING THE D6 DOZER. Slurry is pumped from Trench and DRY BENTONITE is allowed to BE mixed. Filling is from the high end and backfill allowed to run down slope of the Trench

Required Testing Performed (By Inspector/Others)

pulled sample of Key-in mat'l AT 1496 AND A BACKFILL sample @ 4+50. NO Slurry samples were pulled from pencil due to NO mixing

Visitors Mike Williams

Signed

Timothy J. [Signature]

TESTING

BOTTOM OF TRENCH	FINISH	BALANCE	PRESS	TEMP
1+70	48 SEC	69.0	14.0	43°
4+50	48 SEC	69.5	14.0	43°

DRAFT

TOP OF TRENCH.

2+50	52 SEC	72.0	13.5	41°
5+50	48 SEC	73.0	15.0	41°

— No mixing from pond
was added during
entire clay
Therefore no Testing.

Backfill MATL

Raw Gradation @ 1+96

WET DENSITY = 117 ^{lb}/ft³

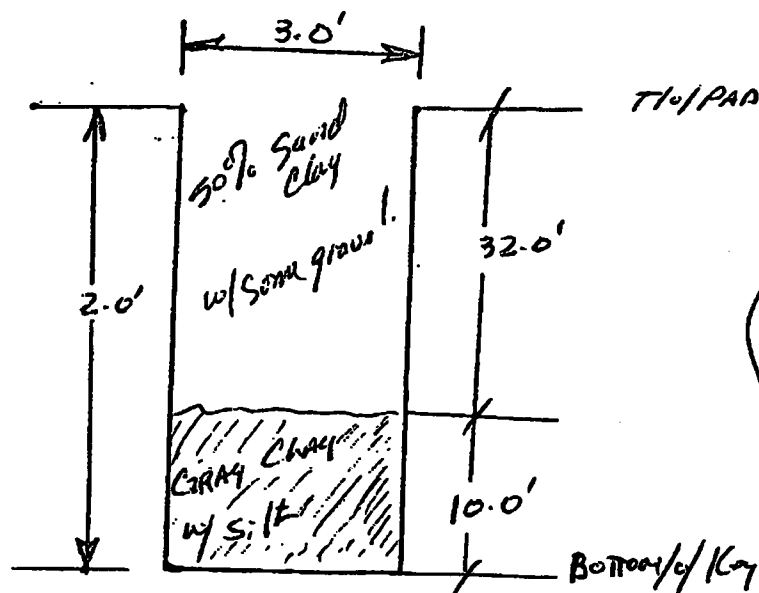
Scump 4 1/2" @ 43°F

P-200 = 76.4%

BFI was to do
monitoring of site
IF WE WERE TO
WEAR OUR PROTECTIVE
MASK AND ETC. presently
NOTHING IS REQUIRED.

Soil Profile @ 4+50

PRIOR TO CONSTRUCTION.



RESIDENT INSPECTION REPORT

Booth & Van Dyke

FORM #

172 PM

DATE REVISED

6-15-84

DATE

DECEMBER 28, 1983

Job No. BBB59

Contract

DRAFT

Owner BFI OF ILLINOIS Project SLURRY WALL CONSTRUCTION

Project Location WINTHROP HARBOR

Report No. 11

Weather Windy - Cold - Windchill -11°

Rain ☐ Snow ☒ Temp 10°

Contractor CASE INTERNATIONAL

Superintendent SUE BRECKENRIDGE

ROSELLE, ILLINOIS

Foreman LAMAR TOLLO

Work Completed

FBI PAGES 47-51

BEGAN CONSTRUCTION OF THE TRENCH FROM ST-50 MOVING SOUTH ON WALL. BACKFILLING IS BEING MIXED ON WORK PAD AREA. Water from the trench is BEING MIXED WITH BACKFILL (EXISTING MAT'L) FROM THE TRENCH. DRY BENTONITE IS ADDED TO BACKFILL AT A RATE OF 1-1066 KOENIGS BACKFILL 4 TONS PER 200 LINEAL FOOT. VERTICALITY OF 1- DG CAT DOZER THE CUT OFF WALL IS CHECKED BY LEVEL 1- RUBBER TIRE LOADER WHICH IS MOUNTED ON COUNTER WEIGHT 4- PUMPS w/ GEN. HAD CASE DO A BACKFILL SLOPE 5 MEN 3 WOMEN AND FOUND IT TO BE AT A 1:6 SLOPE

Items of Interest (Include methods of installation, bracing, sheeting, dewatering, blasting, etc.)

The Backfill was placed back into trench at a slump of 5". With a slump of 5" the backfill was unable to be 25'-100' BEHIND BACKPOE. IT WAS DECIDED THAT THE SLUMP IS MORE IMPORTANT THAN HAVING SPACING OF DELAYS 25'-100'. Contractor was responsible for the trench as NOT TO HAVE ANY CURVE-INS SO WE STAYED WITH A 4"-6" SLUMP AS PER SPEC.

Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.)

Backfill operation is by using the DG CAT DOZER TO MIX THE EXISTING MAT'L WITH DRY BENTONITE AND FRESH SLURRY. THE LOADER IS HAULING DRY MAT'L TO DOZER AND HAULING BACK SLURRY TO THE "DAY LIGHT" END OF BACKFILL.

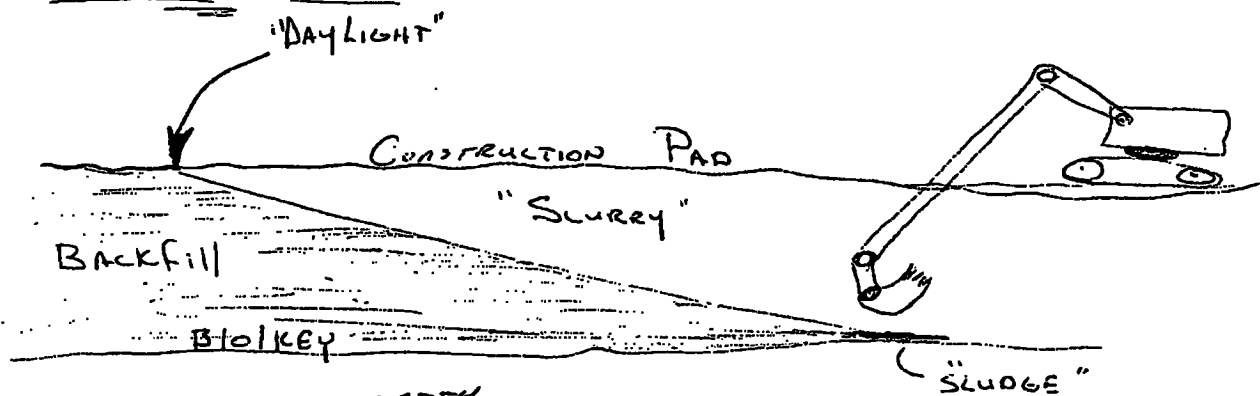
Required Testing Performed (By Inspector/Others)

TESTS WERE PERFORMED ON THE SLURRY AT THE END- TOP OF TRENCH AND AT THE BOTTOM WITH RESULTS ON BACK. GRADATIONS WERE RUN

Visitors John Dixon

Signed

Timothy J. Anderson

BACKFILL MONITOR**DRAFT**

STATION	DEPTH BLOKEY PAD
3+80	10'
3+90	11'
4+00	17'
4+10	17'
4+20	17'
4+30	18'
4+40	19'
4+50	21'
4+60	22'
4+70	24'
4+80	27'
4+90	29'
5+00	32'
5+10	34'
5+20	34'
5+30	35'
5+40	35'
5+50	40'
5+60	42'

- BFI began removing trash from site using the hoe and scrapers @ station 10+00 They were looking for where end of garbage is and then marked it for & cut off wall will most likely be located at.

Delays: Backhoe Airlines are freezing up as of 1:45 which is slowing up the digging operation - and finally stopped at 3:30.

Daylight of Trench at 2:30 w/ Top @ 6+00

Key in samples pulled @
5+50 & 6+50

Backfill

3150 WET DENSITY = 112.5 lb/ft³
SLUMP = 5"
P200 = 72.8%

TESTING
ON THE BACKFILL.

SLURRY LOCATION	Funnel	Balance	Press	Temp
Pond	42	65.5	14.5	38°
Pond	56	65.0	13.5	38°
Pond	51	66.0	14.0	39°
Pond	41	65.0	14.5	41°
7+80	48	72.0	15.0	40°
6+00	47	70.0	14.5	40°
5+80	52	74.0	15.0	38°
6+30	50	71.5	15.0	43°

} Bottom of Trench
Top of Trench.

RESIDENT INSPECTION REPORT

Booth & Van Dyke

FORM #

172 PM

DATE REVISED

6-15-84

DATE

DECEMBER 29, 1988

Job No. 88B59

Contract

Owner BFI OF ILLINOIS Project Slurry Wall Construction

Project Location Winthrop Harbor

Report No. 12

Weather Sunny - SKIGHT WIND - -10° Windchill

Rain ☐ Snow ☐ Temp 10°

Contractor CASE INTERNATIONAL
ROSELLE, ILLINOIS

Superintendent Sue Backlund

Foreman LAMAR TODD

Work Completed

FBI PAGE 51-55

BEGAN CONSTRUCTION AT STATION 6+90 MOVING Southward on wall to
STATION 7+70. THE Trench was MEASURED DEPTH EVERY 10' FROM TOP OF
CONSTRUCTION PAD. THE PAD WAS SHOT ON E EVERY 10'. THE VERTICALITY
OF WALL WAS CHECKED WITH LEVEL WHICH WAS MOUNTED ON THE
EQUIPMENT BACKHOE'S COUNTERWEIGHTS. AT

1-1066 Kobler's Backhoe STATION 7+06 WE CAST A MONITORING

1-106 CAT DOZER WELL FROM E WELL TO E WALL

1- LOADER RUBBER TIRE WE HAVE A SEPARATION DISTANCE

4- PUMPS OF 13.0'

1- MEN - B. WILSON

Items of Interest (Include methods of installation, bracing, sheeting, dewatering, blasting, etc.)

Delays BACKHOE DOWN UNTIL 9:00 HAD TO REPLACE DIAPHRAM
DOZER DOWN AS OF 10:00 TO REPAIR HYDRAULIC LINE AND BACK
IN OPERATION BY Noon.

Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.) EXISTING MATERIAL IS BEING USED FOR BACKFILL dry

BENTONITE IS BEING MIXED WITH THE BACKFILL AT A RATE OF
4 TONS / 200 LINEAL FEET. Fresh Slurry is pumped from holding
pond to GET THE BACKFILL MIXED AND ACTUALLY A 4"6" Slump. →

Required Testing Performed (By Inspector/Others) Samples were pulled at 3:00
on BACKFILL with Slurry BEING TESTED AT BOTTOM OF Trench
at the top of the Trench.

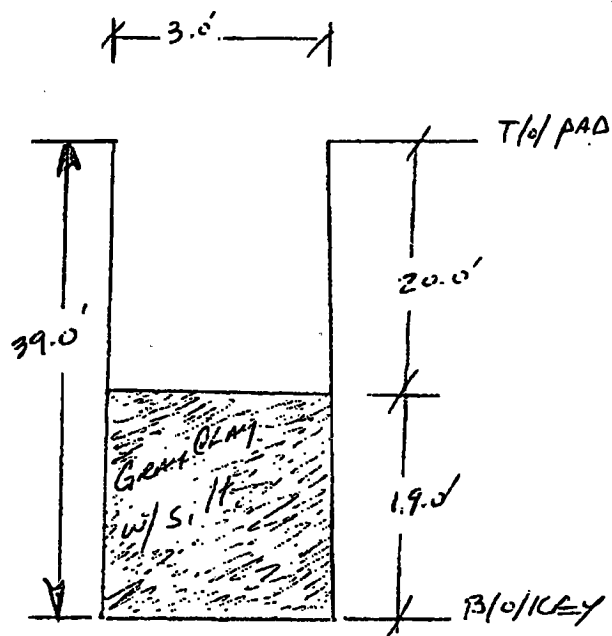
Visitors Nick De - Tom Ryan - Kevin Joslyn - Paul

DUKE LAGER - CASE INTERNATIONAL

Signed

Timothy J. Ambrosini

SOIL CONDITIONS PRIOR TO CONSTRUCTION

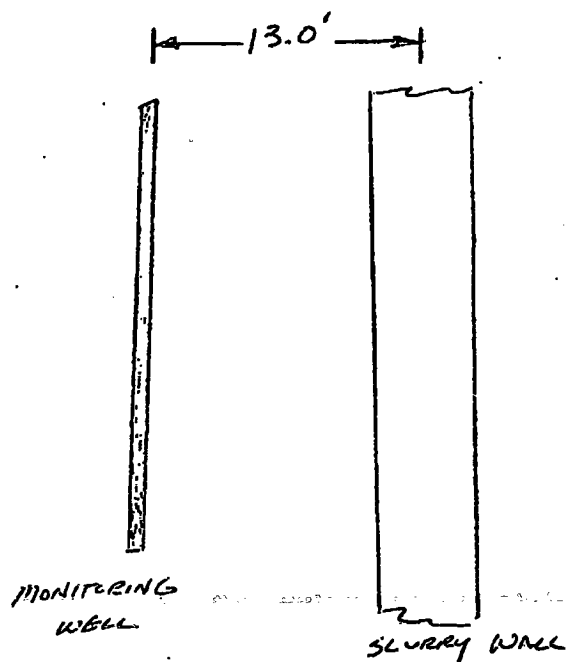


Backfilling Continued
- The mixed backfill is pushed into Trench from the high end and allowed to roll into Trench.
IE Filling at the "day light" end.

DRAFT

Samples of Key-in ~~soil~~ MAT'L HAS BEEN
BEING PULLED EVERY 100'
AND AT STATION 7+50

LOCATION OF WALL TO WELL Monitor. STATION 7+06



WALL LIES 13.0'
EAST OF MONITORING WELL
@ STA. 7+06 IN
RELATIONSHIP TO WALL
CORNER.

Foth & Van Dyke

RESIDENT INSPECTION REPORT

FORM #

172 PM

DATE REVISED

6-15-84

DATE

DECEMBER 30, 1988

Job No. 88B59

Contract _____

Owner BFI OF ILLINOISProject SLURRY WALL CONSTRUCTION**DRAFT**Project Location WINTHROP HARBORReport No. 13Weather SUNNY - SLIGHT WINDRain ☐ Snow ☐ Temp 20NContractor CASE INTERNATIONALSuperintendent Sue BeckenridgeROSELLE, ILLINOISForeman Lamar Todd

Work Completed _____

FB 1 PAGE 55-60

BEGAN WALL TRENCHING AT STATION 7+70 MOVING SOUTHWARD FROM / TO
STATION 8+50 TRENCH DEPTH WAS MEASURED FROM TOP OF CONSTRUCTION PAD
TO BOTTOM OF KEY EVERY 10' MEASURING WITH A WEIGHTED TAPE.

EQUIPMENT

THE VERTICAL OF THE TRENCH WALL WAS CHECKED

1- 1966 KOENIG BACKHOE

USING A LEVEL WHICH WAS MOUNTED ON

1- DL CAT DOZER

BACKHOE'S COUNTER WEIGHT. BFI HAULING

1- RUBBER TIRE LOADER

IN CLAY FILL THE BORROW MAT'L PIT

4- PUMPS

WHICH WAS ON SITE. BFI USING

5 MEN - 3 WOMEN

2- 627 CAT SCRAPPERS. DL CAT USING

THIS MATERIAL TO BEGIN BACKFILL MIXING

Items of Interest (Include methods of installation, bracing, sheeting, dewatering,
 blasting, etc.) JOHN OF BFI AND MYSELF STAKED THE E OF THE

SLURRY TRENCH CUT OFF WALL. THE PAD IS ON A GRADE DOWNWARD
ON A 1.45% TOWARD THE SOUTH THIS IS CAUSING A PROBLEM
IN KEEPING THE SLURRY AT A 2.0' LEVEL FROM THE

Delays TOP OF PAD.

↳ BACKHOE DOWN TO ALLOW THE BACKFILL OPERATION
TO BEGIN.

Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special
 problems, etc.) BACKFILL MAT'L IS BEING HAULED DOWN TO CONSTRUCTION

PAD FROM BORROW SITE. DL DOZER IS MIXING FRESH SLURRY IN WITH CLAY
BENTONITE AND WORKED TILL A SLUMP OF 4"-6" IS OBTAINED.

"DAYLIGHT" AT 5:00 WITH TOP AT 7:00

Required Testing Performed (By Inspector/Others) TRENCH SLURRY, PAD and

BACKFILL WAS SAMPLED AS PART OF THE QA/QC PROGRAM

OVER

Visitors _____

Signed

Timothy J. Anderson

DRAFT

Key - In Samples pulled @ B+50

- TESTING -

SLURRY

LOCATION	FUNNEL	BALANCE	Press	TEMP	
7+60	54	65	14.5"	38°	} BOTTOM
7+50	54	67	13.0	37°	
B+50	50	68	14 1/2	47°	} TOP
7+50	48	50	15.0	45°	
—	53	65	14.0	43°	} POND
—	54	64	15.0	40°	
—	41	65 1/2	15.0	45°	
—	41	66	15.0	47°	

BACKFILL GROUNDATION

6" Slump

116 15/ft³ DENSITY 75.5%
P-200

6" Slump

120 16/ft³
P-200 86.6%

Foth & Van Dyke

RESIDENT INSPECTION REPORT

FORM #

172 PM

DATE REVISED

6-15-84

DATE

DECEMBER 31, 1988

Job No. BBB59

Contract

DRAFTOwner BFI OF ILLINOISProject SLURRY WALL CONSTRUCTIONProject Location Winthrop HarborReport No. 14Weather Sunny & Warm BeautifulRain ☐ Snow ☐ Temp 30°Contractor CASE INTERNATIONALSuperintendent Steve BreckenridgeROSELLE, ILLINOISForeman Lamar Todd

Work Completed

FB 1 PAGE 61-64

BEGAN TRENCHING AT STATION 8+50 MOVING SOUTHWARD TO
STATION 9+70. THE PAD WAS SHOT EVERY 10' AND THE H/W WAS
MEASURED EVERY 10' WITH A WEIGHTED TAPE TO DETERMINE THE BOTTOM OF
KEY ELEVATION. LEVEL WHICH IS MOUNTED ON BACKHOES
EQUIPMENT. COUNTERWEIGHT WAS CALLED THROUGHOUT
1-1066 KOEHRING BACKHOE THE DAY. THIS WAS CHECKING FOR VERTICAL
1- D6 CAT DOZER OF WALL. CASE AND MYSELF SHOT THE
1- LOADER COMPANION TOP OF PAD AT STATION 10+10 TO
A - PUMPS STATION 11+00 EVERY 10' ON E. PAD.
5 MEN 3 WOMEN

Items of Interest (Include methods of installation, bracing, sheeting, dewatering, blasting, etc.)

BFI BEGAN RAISING THE CONSTRUCTION PAD AT STATION 9+30
MOVING TO SOUTH TO HELP GET SLURRY LEVEL BACK TO 2' BELOW
TOP OF PAD. FINISHED BUILDING PAD TO STATION 10+00. BFI AND
MYSELF SHOT THE TOP OF PAD EVERY 10'

Delays BACKHOE WAS DOWN FOR 1 1/2 HRS TO ALLOW SLURRY TO
BE PUMPED INTO TRENCH AND RAISE THE LEVEL TO BE 2' BELOW
TOP OF PAD

Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.)

BORROW MAT'L IS BEING HAULED IN FROM BORROW PIT ON SITE
BY BFI TO BE USED FOR BACKFILL. D6 CAT DOZER TOOK BACKFILL MIXED WITH
FRESH SLURRY AND NEW BENTONITE AT A RATE OF 4 TONS / 200 FEET. Once
BACKFILL HAS BEEN N/A A 6" SLUMP IS PUSHED INTO TRENCH FROM HIGH OFF

Required Testing Performed (By Inspector/Others)

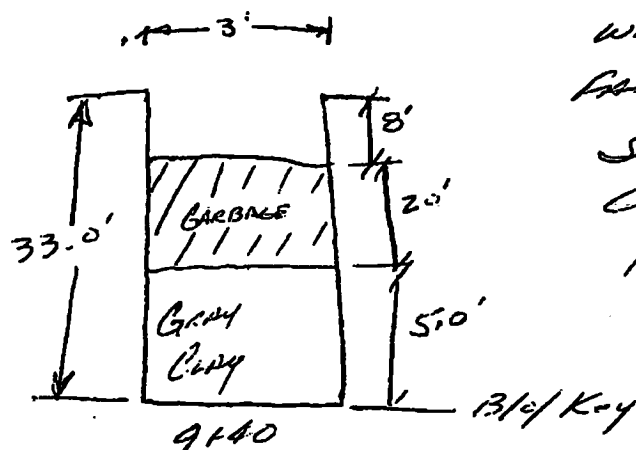
NO SLURRY FROM PENCIL WAS
PUMPED BUT RAN TESTS ON SLURRY AND BACKFILL.

Visitors

Signed

Timothy J. [Signature]

- AT STATION 9+00 HEAVY AMOUNT OF CLAY WAS ENCOUNTERED. THE CLAY WAS 20' THICK. BFI



WANTED WALL TO BE AS FAR EAST AS POSSIBLE SO THE MAXIMUM AREA CAN BE USED TO BUILD THE 2ND SECURED CELL.

DRAFT

BACK FILLING

END AND ALLOWED TO Ooze INTO THE TRENCH

"Day Light" of BACKFILL operation AT 9+00 WITH THE TOE AT 8+50

SAMPLES OF KEY IN WERE OBTAINED @ 9+50

WITH BACKFILL SAMPLES AT 3+00 & 4+00

WHERE 3+00 WAS 2 Shelby Tubes.

- TESTING -

STATION	funnel	BALANCE	Press	Temp	
8+60	50	72.5	14.0	40°	} BOTTOM OF TRENCH
8+80	53	70.0	14.5	40°	
8+00	50	68.5	14.5	40°	
7+00	50	67.0	15.0	40°	
					} TOP OF TRENCH

BACKFILL

SLUMP = 5"
DENSITY = 119 $\frac{lb}{ft^3}$ P200 = 75.6%

Foth & Van Dyke

RESIDENT INSPECTION REPORT

FORM #

172 PM

DATE REVISED

6-15-84

DATE

JANUARY 1, 1989

Job No. BB 1359

Contract _____

Owner BFI OF ILLINOIS

Project

SLURRY WALL CONSTRUCTION**DRAFT**Project Location Winthrop HarborReport No. 15Weather FOGGY - SLIGHT WINDRain ☐ Snow ☐ Temp 20 inContractor CASE INTERNATIONALSuperintendent SUE DEERBRIDGEROSELLE, ILLINOISForeman LAMAR TODD

Work Completed _____

BFI PAGE 65 -

CASE BEGAN TRENCHING FROM STATION 9+70 MOVING SOUTH TO STATION 10+70. WALL ALIGNMENT WAS AS FAR EAST AS BACKHOE TO GO SUCH THAT IT WAS SITTING LEVEL. THE KEYWAY WAS MEASURED EVERY 10' WITH A WEIGHTED TAP MEASURE AS TO THE SAME LOCATION IS OF WATER & EQUIPMENT OF PAD WAS SHOT AT. WE CONTINUED TO 1-10666 ROERING BACKHOE EXCAVATE THROUGH CARPANE. LEVEL WAS 1- DG CAT DOZER USED TO CHECK VERTICAL OF WALL 1- Ribbon Trench Loader SHOT THE PAD AGAIN FROM 11:10 TO 12:00 1- PUMP ON & EVERY 10' w/ BFI.

MEN 3 WORKMEN

Items of Interest (Include methods of installation, bracing, sheeting, dewatering, blasting, etc.) AS THE CARPANE IS ENCOUNTERED THE CAT'S AND SCRAPERS OF BFI ARE BEING LOADED BY BACKHOE AND DISPOSING OF THE CARPANE ON THE HARMONIOUS SITE. WE HAVE ANY CARPANE ON BACKHOE WE ARE TO REMOVE THE ENTIRE BACKHOE.

Delays _____

Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.) Backfill is being hauled in from borrow pit which was on site. Fresh Slurry is pumped into backfill and dry Bentonite is added. The Dozer works backfill such that a 4"-6" slump was achieved and then pushed in at the "Daylight" at the Trench. "Daylight" = 5+20 To 10+50

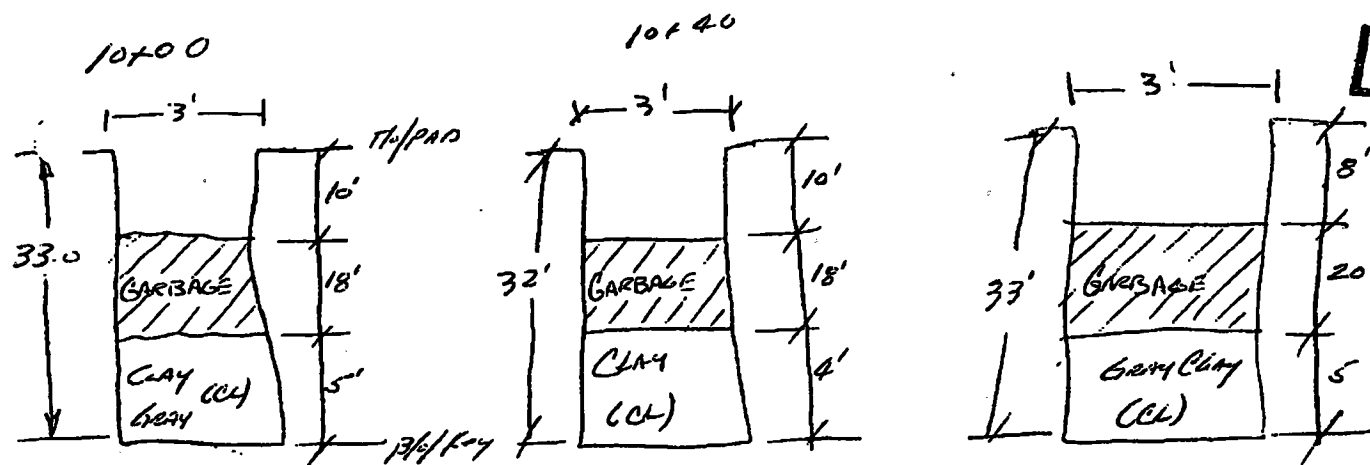
Required Testing Performed (By Inspector/Others) TESTS WERE PERFORMED ON BOTH BACKFILL AND ON THE TRENCH SLURRY

Visitors _____

Signed

Timothy J. Ambrosini

Soil Profiles Prior To Construction.



TESTING

STATION	funnel	Balance	Press	Temp
8+50	58	70	13 1/2	37°
9+50	65	72 1/2	13 1/2	36°
10+20	53	73	13 1/2	40°
10+00	57	72 1/2	12 1/2	34°
—	44	68	13.0	37°
—	42	67 1/2	13.0	37°
—	42	66 1/2	13.0	37°
—	42	66 1/2		

Backfill @ 4+00
5" slump

119.5 13 1/2

P-200 Content = 76.7%

In digging thru garbage I have concern about how the garbage is to be removed on the west side of wall.
MUST TALK with BFI ASAP.

RESIDENT INSPECTION REPORT

Booth & Van Dyke

FORM #

172 PM

DATE REVISED

6-15-84

DATE

JANUARY 2, 1989

Job No. 88B59

Contract

Owner BFI OF ILLINOIS

Project SLURRY WALL CONSTRUCTION

DRAFT

Project Location WINTHROP HARBOR

Report No. 16

Weather Sunny - Windchill -10°

Rain ☐ Snow ☐ Temp TEEN'S

Contractor CASE INTERNATIONAL

Superintendent SUE BRIDGEMAN

ROSELLE, ILLINOIS

Foreman LAMAR TOLLE

Work Completed

FB 1 PAGE 70-74

BEGAN TRENCHING OF CUT OFF WALL AT STATION 10 TO MOOING
SOUTHWARD TO STATION 12+00. CONTRACTOR CONTINUES TO DIG THROUGH
GARAGE. GARAGE IS BEING HANDLED AWAY BY SCRAPPER OF BFI
LOADED WITH PARKER AND IT'S BEING HANDLED TO
EQUIPMENT THE HAZARDOUS SITE. THE LEVELNESS OF THE
1-1066 KOENIGS PARKER was checked using a level mounted on the
1- DO CAT DOZER. BROKE SO WALL MUST BE VERTICAL
1- RUBBER TIRE LOADER BFI AND MYSELF SHOT THE REMAINING
1- JEN PUMP SETS CONSTRUCTION AND WHICH WAS RAISED UP
2 MEN 3 WOMEN. THIS MORNING - WE SHOT IT ON E EVERY 10'

Items of Interest (Include methods of installation, bracing, sheeting, dewatering, blasting, etc.) BFI WAS DOING SOME AIR MONITORING DURING DAY AND NOTHING ACCORDING TO THEM WAS PICKED UP.

Delays HOE DOWN FROM 10:45 TO 12:30 DUE TO THE PUMPS
BEING FROZE UP. SLURRY WAS GETTING TOO LOW IN THE TRENCH.
SMALL DILLS WERE BUILT TO HELP KEEP THE SLURRY HIGHER DUE TO 1.5% SAND

Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.) DO CAT DOZER MIXING FRESH SLURRY WITH BACKFILL AND
CLAY BENTONITE SUCH THAT A SLUMP OF 4" 6" IS REACHED AND IS PUSHED
INTO TRENCH AT THE "CLAY LIGHT" AND, AND ALLOWED TO RUN INTO
THE EXCAVATED TRENCH.

Required Testing Performed (By Inspector/Others) NO SLURRY WAS MIXED SO NO
TESTING ON THE PUMP WAS PERFORMED BUT TESTS WERE TAKEN AT
TRENCH AS WELL AS ON THE BACKFILL

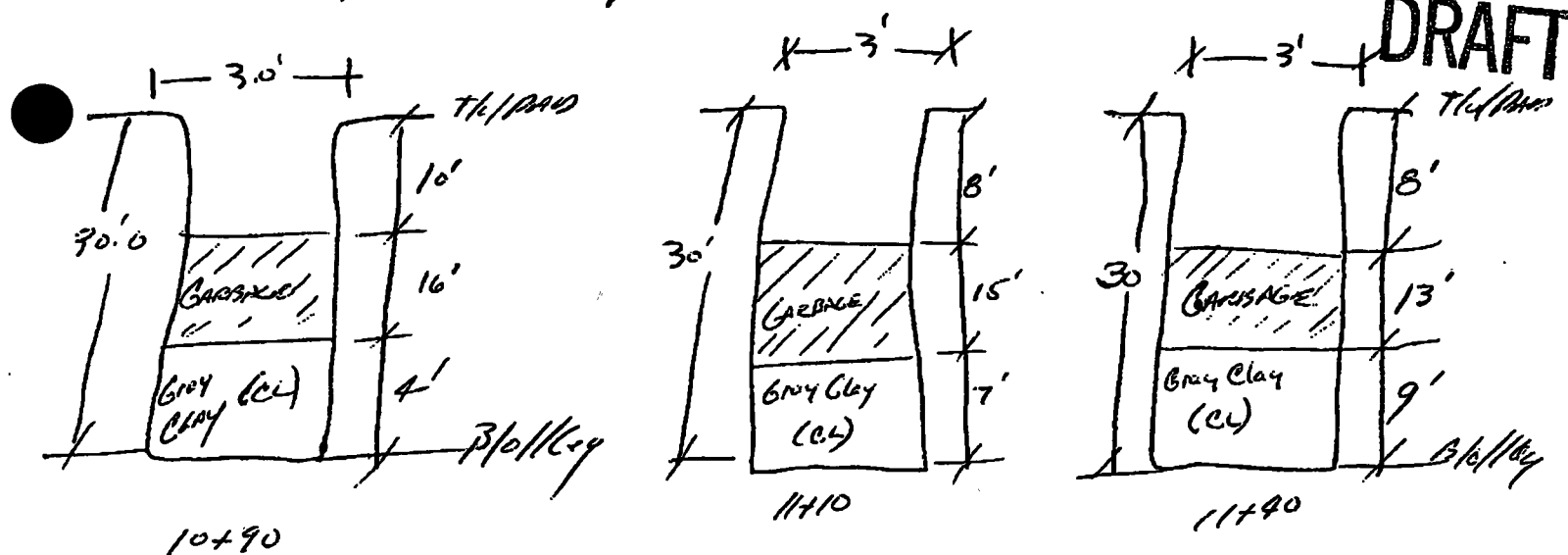
Visitors

Signed

Timothy J. Ambrosio

Soil Profiles prior to Construction

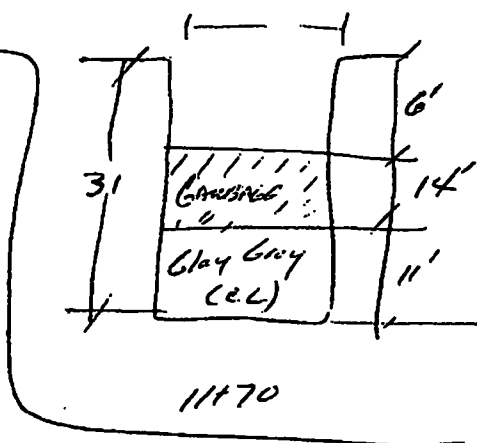
DRAFT



TRENCH Profile of Backfill

STATION	DEPTH from P.A.O.
9+00	0'
9+20	3'
9+40	7'
9+60	7'
9+80	11'
10+00	11'
10+20	13'
10+40	14'
10+60	14'
10+80	15'
11+00	17'
11+20	18'
11+40	23'
11+60	25'
11+80	27'
12+00	30'

Daylight at 9+00: Toe @ 12+00



TESTING	Shrinkage	Balance	Press	temp
ST: Funnel				
10+50 S3	72.0	13.0	43°	Top
11+50 S5	70.0	13.5	43°	
10+60 S4	73 1/2	13.5	39°	Bottom
10+40 S1	72 1/2	13.5	39°	

Backfill 600

Slump = 6"

Density = 120 lb/ft³

P-200 Content = 76.1%

Foth & Van Dyke

RESIDENT INSPECTION REPORT

FORM #

172 PM

DATE REVISED

6-15-84

DATE

January 3, 1989

Job No. 88BS9

Contract

Owner BFI OF ILLINOIS

Project

SLURRY WALL CONSTRUCTION

DRAFT

Project Location Winthrop AvenueReport No. 17Weather OVERCAST - 1-4Rain ☐ Snow ☐ Temp 30°NContractor CASE INTERNATIONALSuperintendent SIC BeckenridgeROSELLE, ILLINOISForeman LAMAR TROOP

Work Completed

PB 1 PAGE 75-78

TRENCHING BEGAN AT STATION 12+00 MOVING SOUTHWARD TO STATION 12+90. THE MINIMUM DEPTH WHICH THE DIG RAN AT A DEPTH OF 31.0'. THE PAD WAS FIRST LAYED 10' ON CENTERLINE PRIOR TO CONSTRUCTION AND A WEIGHTED TAPR WAS USED TO MEASURE DEPTH EQUIPMENT OF KEY TO TOP OF PAD. THE VERTICAL 1-10000 HOORING BACKLOG OF WALL WAS CHECKED WITH A 100' MOUNTED 1-DO CAT DIGGER AND THE COUNTRY WEIGHT OF BACKLOG 1- Rubber Tire Loader BFI CONSTRUCTED PAD TO STATION 13+00. BFI HAD PUMPING CONCRETE FROM MEN - 3 WOMEN USING 2- CAT SCRAPERS WHICH ARE BFI

Items of Interest (Include methods of installation, bracing, sheeting, dewatering, blasting, etc.) LOADED BY THE BACKLOG. CONTRACTOR HAD LATERAL DRAIN PIPE FROM EXHAUSTIVE STORAGE TANK AT STATION 11+75
SPRINKLING

Delays CONSTRUCTION HAS BEEN SLOW WITH CLOGGING THROUGH THE GROUND - IT'S VERY HARD FOR MACHINE TO PULL THE GROUND AND HAVING TO LOAD SCRAPERS

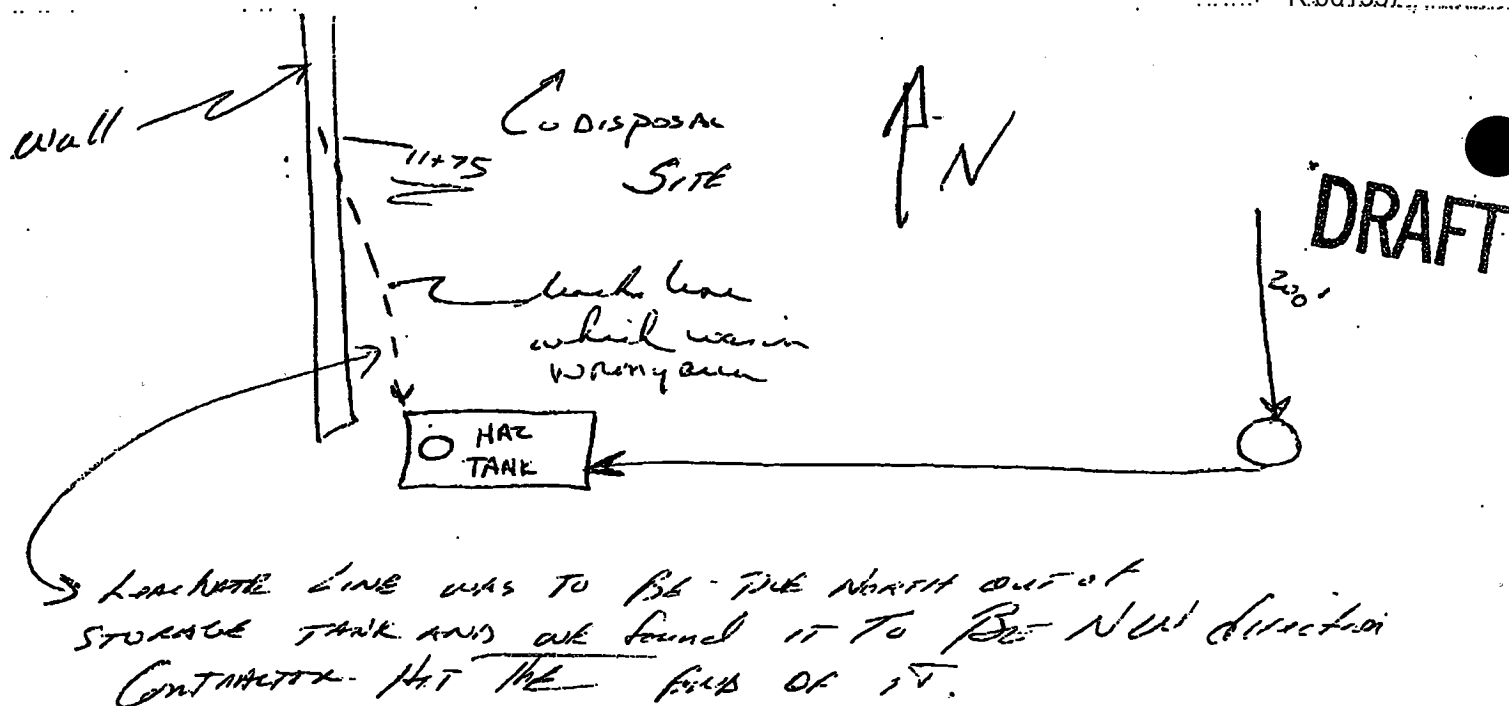
Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.) BACKFILL OPERATION IS CONTINUING WITH EXISTING MAT'L BEING USED AS BACKFILL FRESH SLURRY FROM POND IS BEING PUMPED INTO THE BACKFILL AND BEING WORKED IN W/ DO CAT DIGGER. DRIP BENTONITE HAS BEEN ADDED. THE BACKFILL WAS MIXED TO A

Required Testing Performed (By Inspector/Others) SLURRY WAS TESTED AT BOTH BOTTOM AND TOP OF TRENCH. A BACKFILL
WAS RUN AT STATION 9+00

Visitors JM of Foth & Van DykeJohn Dixon - BFI

Signed

[Signature]



Backfilling

POINT SUCH THAT A SLUMP WAS BETWEEN 4" - 6". The backfill was pushed into the trench from the high end and slumped to sleep into the trench.

"DAY LIGHT" @ 9:00 AND TOP OF BACKFILL @ 12:00

TESTING

STATION	Funnel	BALANCE	Press	Temp	
	42	66.0	14.0	37	} Period
	43	66.5	14.0	37	
	43	69.0	17.5	39	
	41	69.0	15.0	39	
11:00	3049	70	13.5	38	} top
12:00	50	68	14.0	38	
11:00	51	74	14.0	43	} Bottom
12:00	47	70	14.0	43	

Backfill @ 9:00

5" Slump

117.5

16/ft 3 P200 Content = 73.9%

RESIDENT INSPECTION REPORT

172 PM

6-15-84

DATE January 4, 1989

Contract

Project

Surry Wall Construction

DRAFT

Report No. 18

Rain ☐ Snow ☐ Temp 72ins

Superintendent L. H. MacKenzie

Foreman Lamar Todd

FBI PAGE 79-23

13+25 WHICH WAS THE END OF THE WALL BACK ROW

REMAINED ON PAD UNTIL BACKLIT WAS ABLE TO BE REMOVED

By REMOVING THE BACKFILL CONTRACTOR WAS ABLE TO BE SURE

EQUIPMENT The Baron of The Trunk was

1-1000 Kehrini Bunkel

Letter of "Shelby" The

1-06 Pa-Driver

Reg. depth was exceeded over

1-LOADER COMPENELLA

10' - Traffic on Counter weight

4 241 mg's

of Back to Back verticals

Handwritten - 3 pages

of 3:11

blasting, etc.) *Once the sledge was removed the water moved*

Go BACK TO The North end of site to the dig point

WHAIR. FRONT TOP FILLED IN. BFI WORKED THE REST OF THE DAY CLEANING UP LOADING AREA & WHAIR. SCRAPPER ARE LOADED.

Delays DOZEN DOWN BROKE BOLTS OUT OF BEARING

Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.) *Backfilling operation continued with Backfill material.*

Being handled in form on site Brown pt. Backfill is mixed with

Each Sluice and one Bentonite is also placed in the Bulk II. IT

13 mixed with No. 12 and pushed into French at Daylight @ 10:50 & Toep 12:40

Required Testing Performed (By Inspector/Others) Slurry was mixed and

PUMPED TO HOUSING POND WITH TEST RAN ON IT AS WELL AS

Success from the French.

Visitors Bob Mactan - Case International

Signed

Wm. H. I. Phoenix

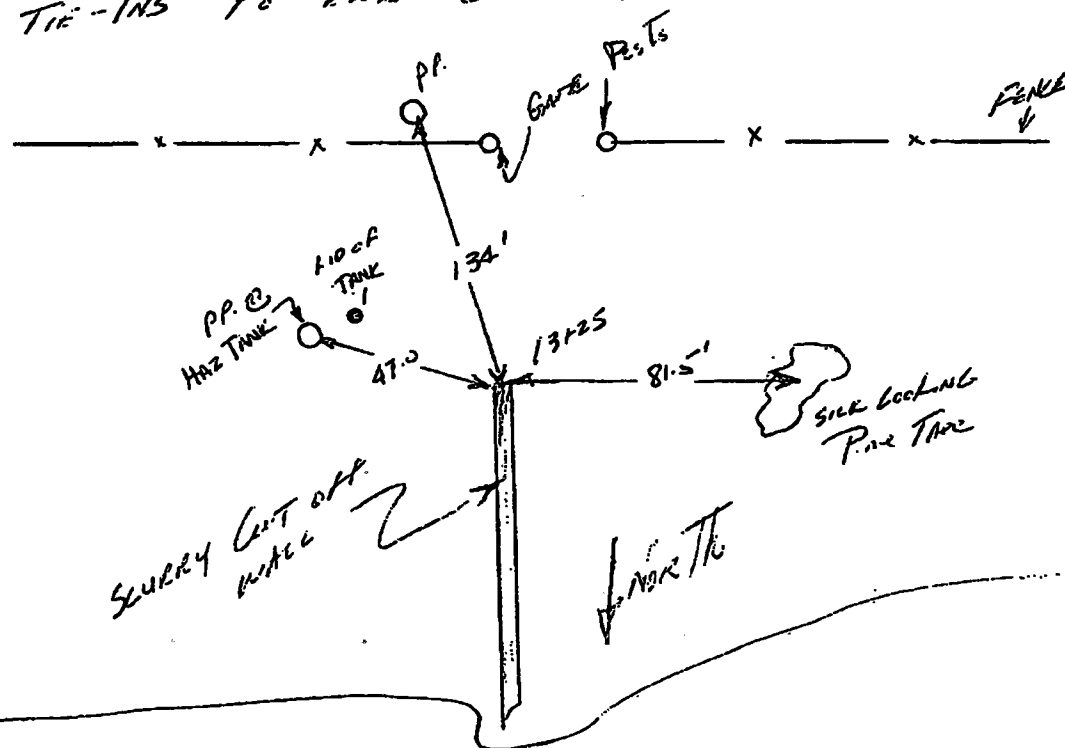
TESTING

funnel	balance	Press	Temp
40	66	15.0	38
40	64	15.0	38
41	65	15.0	
47	72	15.0	37
52	70	15.0	37
53	70	15.0	37
		14.5	37
			40

Backfill samples were
pulled but none
no gradations on
them.

DRAFT

Tie-Ins to ends of wall



Can setting up the slurry pipes again such that
they can re-dig the station 0+00 to 0+60 again
and remove the frozen pieces.

Eoth & Van Dyke

RESIDENT INSPECTION REPORT

FORM #

172 PM

DATE REVISED

6-15-84

DATE

JANUARY 5, 1989

Job No. 88B59

Contract

Owner BFI OF ILLINOISProject Slurry Wall ConstructionProject Location Winthrop AvenueReport No. 19Weather SunnyRain ☐ Snow ☐ Temp ClearContractor CASE INTERNATIONALSuperintendent Sue BrackenridgeROSELLE, ILLINOISForeman LAMAR Todd

Work Completed

FB1 page 84-88

CASE BEGAN CONSTRUCTION OF TRENCH RE-EXCAVATION ON NORTHERN
OF SITE AT STATION 0+00. THE CONSTRUCTION PAD WAS REBUILT
FROM STATION 1+90 TO STATION 0+00. SLURRY WAS PUMPED
BACK INTO TRENCH SINCE THE AREA WAS IN BROWN DIRT. THIS SLURRY
EQUIPMENT WAS HEAT TO TOP OF THE TRENCH FOR FOUR
10000 HORSEPOWER BACKHOE CO. HAD OTHER CASE-IN. 3 LARGE PILES
1- D6 CAT DOZER OF FROZEN MAT'L WAS REMOVED FROM
1- RUBBER TIRE LOADER THE TRENCH. THE DOZER WAS
A PUMPS CLEARED BY VIBRATING UNDISTURBED
3 MEN 3 WOMEN. TRENCH CUTTING FINISHED TRENCHING TO STATION 0+70.

Items of Interest (Include methods of installation, bracing, sheeting, dewatering, blasting, etc.) BFI BUILT A CERTAIN POND INTO SECOND CELL 2

AREA USING CLAY. POND DIED UP AREA WHERE TRENCH
SLURRY WILL BE REQUIRED TO BE FORCED OUT OF TRENCH WHEN
BACKFILLING COMMENCED. BFI CONTINUED POND OF

Delays BAUMGARTNER & DEBRIS WHICH SPILLED WHILE LOADING THE
SCRAPERS. 873 CAT DOZER PUSHED SOME OF PAD AREA AWAY
TO REMOVE GARBAGE. CAT 225 BACKHOE USED TO LOAD SCRAPERS

Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special problems, etc.) BFI CONTINUE BACKFILLING FROM STATION 1+50 "NIGHT"
WITH TCE AT 13:25. BROWN MAT'L AS WELL AS "MUD MAT'L"
IS BEING USED FOR BACKFILL OF TRENCH. SLURRY AND DRY
BEUTONITE. THE CONSISTENCY OF BACKFILL IS A COMBINATION OF 6" SLUMP

Required Testing Performed (By Inspector/Others) Sampler for Backfill

Water and Slurry Tests

Visitors

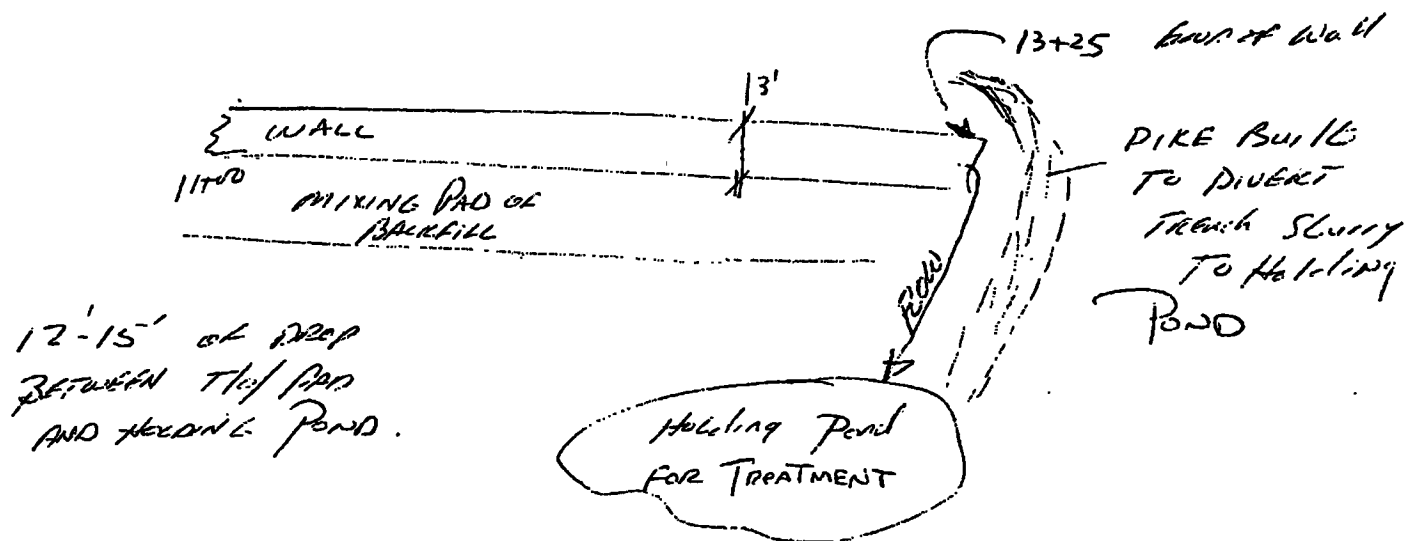
BFI - Houston on Site (2)BFI - Mike L. Hains

Signed

Proffly (Ink)

- 1764 of Interest Continued -
 Scrappers hauled mat to active hazardous site.

DRAFT



IN EXCAVATING THE SPA 0100 TO 0170

Backfill Looked very consistent

Eoth & Van Dyke

RESIDENT INSPECTION REPORT

FORM #

172 PM

DATE REVISED

6-15-84

DATE

JANUARY 6, 1989

Job No. 88 B59

Contract _____

Owner BFI of ILLINOISProject Slurry Wall ConstructionProject Location Winthrop HarborReport No. 20Weather Cloudy - OvercastRain ☐ Snow ☐ Temp 35°Contractor CASE INTERNATIONALSuperintendent Joe BenkenridgeROSELLE, ILLINOISForeman Lamar Todd**DRAFT**

Work Completed _____

IB / page 89-91

CASE BEGAN BACKFILL AT 11175 MOVING SOUTH ON WALL
USING A RENTED DOZER. TRANSMISSION WAS BLOWN ON THE DG.

Sue, Bill, & myself questioned the present trench
CONTAINING THE LEACHATE FROM THE STORAGE TANK.

SUE WANTS TO USE THE TRENCH SLURRY FOR BACKFILL
MIXING. BILL AND MYSELF FEEL WE WILL NOT HAVE
A GOOD WALL. AFTER THINKING ABOUT WHAT WE HAVE
SINCE 9:40 THE TRENCH HAS BECOME "CONTAMINATED"
E TO THE FACT OF DIGGING THROUGH GARBAGE. A TRENCH
(AS OF 9:40)

Items of Interest (Include methods of installation, bracing, sheeting, dewatering,
 blasting, etc.) BILL AND MYSELF FEEL WHAT IS THE DIFFERENCE

NO MATTER WHAT IS DONE TO THE TRENCH IT IS CONTAMINATED.
SO BILL & I FELT WE COULD USE THE TRENCH SLURRY FOR
BACKFILL MIXING. I INFORMED SUE IF THIS WAS IN AN
AREAS AREA WHERE WE HAD AN UNCONTAMINATED TRENCH AND THEN
BROKE A LEACHATE LINE WHICH CONTAMINATED THE TRENCH
SHE WOULD HAVE BEEN CLEANING OUT TRENCH AND

Comments (Include soil conditions, bedding, backfill, rock removal, clay removal, special
 problems, etc.) STARTING OVER. BILL FINISH CONSTRUCTION OF HIS

HOLDING POND OF CONTAMINATE SLURRY OVER

Required Testing Performed (By Inspector/Others) _____

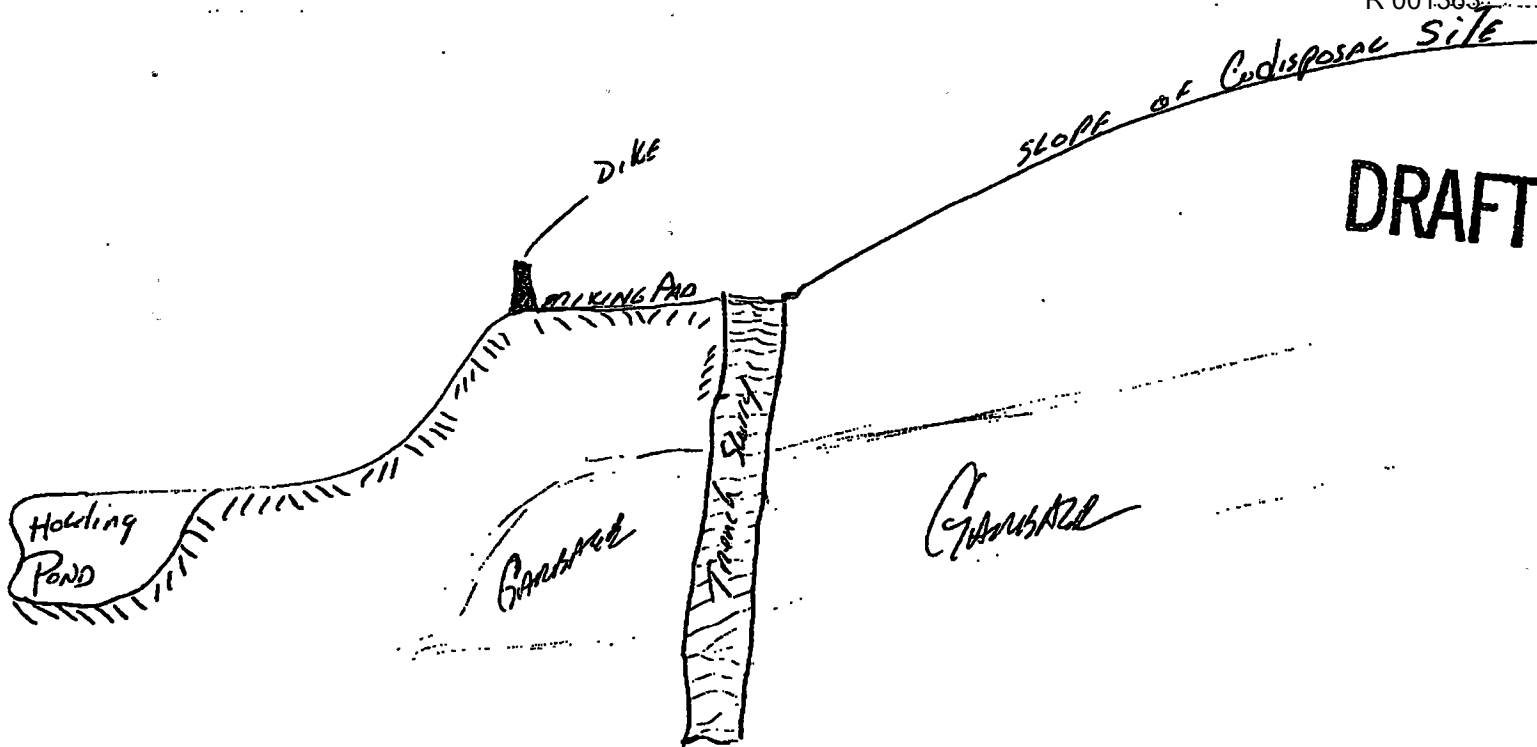
CASE BEGAN MOVING OUT

Visitors _____

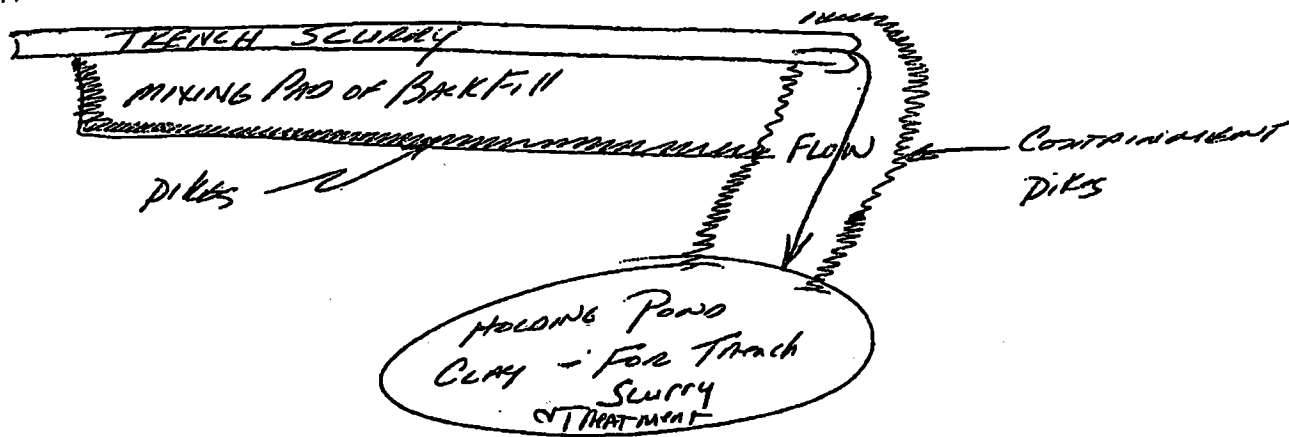
Signed

Timothy J. Paulsen

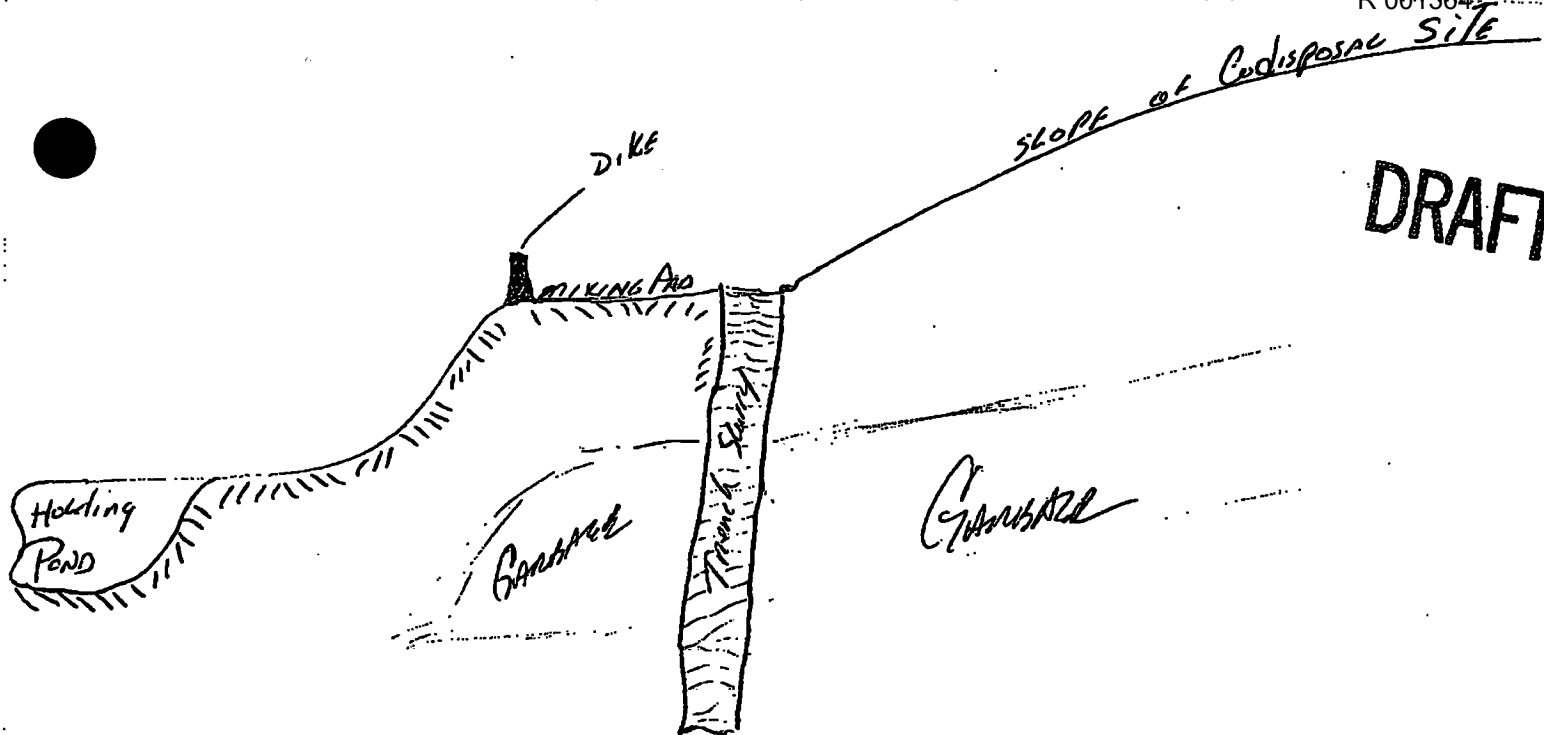
DRAFT



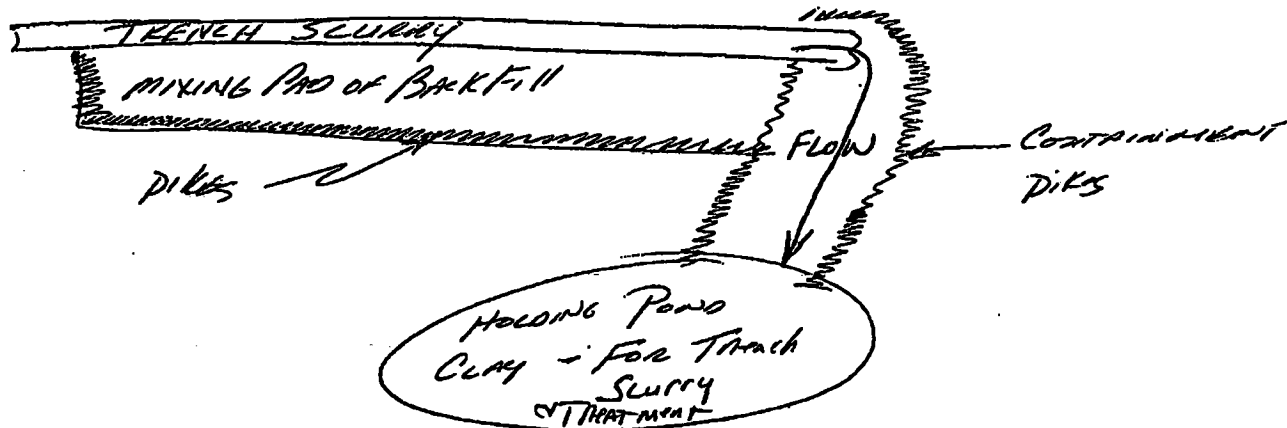
11400



DRAFT



11400



Appendix G

DRAFT

APPENDIX G

Quality Assurance Test Data of Bentonite

CASE INTERNATIONAL

SHIPPED FROM: "BARDONL INDUSTRIES, INC

ZADA STAR ROUTE

COLONY PLANT

BELLE FOURCHE, SO. DAK. 57717

ATTN: MR. BOB MARTIN

PRODUCT - NATIONAL PREMIUM

1988

CAR/TRUCK NUMBER	SHIP DATE	% MOISTURE 10.0 MAX	MESH %200 70.0 MIN	FANN 600-AGED 30-45	PLASTIC VISCOSITY	YIELD POINT <3 X PV	FLUID LOSS 15.0 MAX	%GRIT +200 W.S. 4.0 MAX	pH	RECEIVING LOCATION
NAHX 360033	12-9	9.70	76.5	38.5	12.5	13.5	11.6	1.90	9.0	ZION, ILL

NUMBER of CAR/TRUCK	SHIP DATE	% MOISTURE 10.0 MAX	MESH %200 70.0 MIN	FANN 600-AGED 30-45	PLASTIC VISCOSITY	YIELD POINT <3 X PV	FLUID LOSS 15.0 MAX	%GRIT +200 W.S. 4.0 MAX	pH
1	DEC	M. AVG.	9.70	76.5	38.5	12.5	13.5	11.6	1.90
		STD. DEV.	.00	0.0	0.0	0.0	0.0	.00	.0

NUMBER of CAR/TRUCK	SHIP DATE	% MOISTURE 10.0 MAX	MESH %200 70.0 MIN	FANN 600-AGED 30-45	PLASTIC VISCOSITY	YIELD POINT <3 X PV	FLUID LOSS 15.0 MAX	%GRIT +200 W.S. 4.0 MAX	pH
13	YTD	M. AVG.	8.91	74.9	37.6	13.2	11.2	11.8	2.17
		STD. DEV.	0.49	2.7	1.8	0.8	1.7	0.7	0.45

CASE INTERNATIONAL

P. O. BOX 40

ROSELLE, ILLINOIS 60172

ATTN: MR. BOB MARTIN

CC: JIM ANDERSON

MARK WARNACK

QUALITY ASSURANCE SUPV.

DON SCHULTHESS

12-9-88

DRAFT

R.001367

CASE INTERNATIONAL

SHIPPED FROM: NL LUDANL INDUSTRIES, INC
ALZADA STAR ROUTE
COLONY PLANT
BELLE FOURCHE, SO. DAK. 57717

ATTN: MR. BOB MARTIN

PRODUCT - NATIONAL PREMIUM

1988

CAR/TRUCK NUMBER	SHIP DATE	Z MOISTURE 10.0 MAX	MESH Z-200 70.0 MIN	FANN 600-AGED 30-45	PLASTIC VISCOSITY	YIELD POINT C3 X PV	FLUID LOSS 15.0 MAX	ZGRIT +200 W.S. 4.0 MAX	pH	RECEIVING LOCATION
WAGS 1086	12-16	9.20	79.0	43.5	14.0	15.5	12.2	1.50	9.1	ZION, ILL
NAHX 360029	12-16	9.20	73.2	39.5	13.0	13.5	12.8	2.00	9.1	ZION, ILL

DEC 27

NUMBER of CAR/TRUCK	SHIP DATE	Z MOISTURE 10.0 MAX	MESH Z-200 70.0 MIN	FANN 600-AGED 30-45	PLASTIC VISCOSITY	YIELD POINT C3 X PV	FLUID LOSS 15.0 MAX	ZGRIT +200 W.S. 4.0 MAX	pH
3	DEC	M. AVG.	9.37	76.2	40.5	13.2	14.2	12.2	1.80
		STD. DEV.	0.24	2.4	2.2	0.6	0.9	0.5	0.22

NUMBER of CAR/TRUCK	SHIP DATE	Z MOISTURE 10.0 MAX	MESH Z-200 70.0 MIN	FANN 600-AGED 30-45	PLASTIC VISCOSITY	YIELD POINT C3 X PV	FLUID LOSS 15.0 MAX	ZGRIT +200 W.S. 4.0 MAX	pH
15	YTD	M. AVG.	8.95	75.1	38.1	13.2	11.7	11.9	2.11
		STD. DEV.	0.47	2.8	2.2	0.8	2.0	0.7	0.45

CASE INTERNATIONAL
P. O. BOX 40
ROSELLE, ILLINOIS 60172
ATTN: MR. BOB MARTIN
CC: JIM ANDERSON
MARK WARNACK

QUALITY ASSURANCE SUPV.
DON SCHULTHESS
12-16-88

DRAFT

R-001368

DRAFT

APPENDIX H

**Laboratory Grain Size and
Atterberg Limits Test Results**

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

PROJECT: Winthrop Harbor
Slurry Wall Backfill

SCOPE I.D. #: 88B59

DATE TYPED: 1-26-89

REPORT NUMBER: 1

REPORTED TO: BFI - Waste Systems

DRAFT

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: STA. 1+00

DATE SAMPLED: 12/23/88

SAMPLE NUMBER: GC-1

DATED RECEIVED: 12/27/88

DEPTH OF SAMPLE:

SOURCE OF SAMPLE:

SAMPLED BY: Tim Ambrosius of F&VD

MUNSELL COLOR CODE: 10 YR. 4/3

LABORATORY DATA:

DATE TESTED: December 29-30, 1988

24 HRS. TURN AROUND ☐ YES ☒ NO

TESTED PERFORMED BY: KAS

WASHED GRADATION ☒ YES ☐ NO

REVIEWED BY: R. Rouse 1-16-89

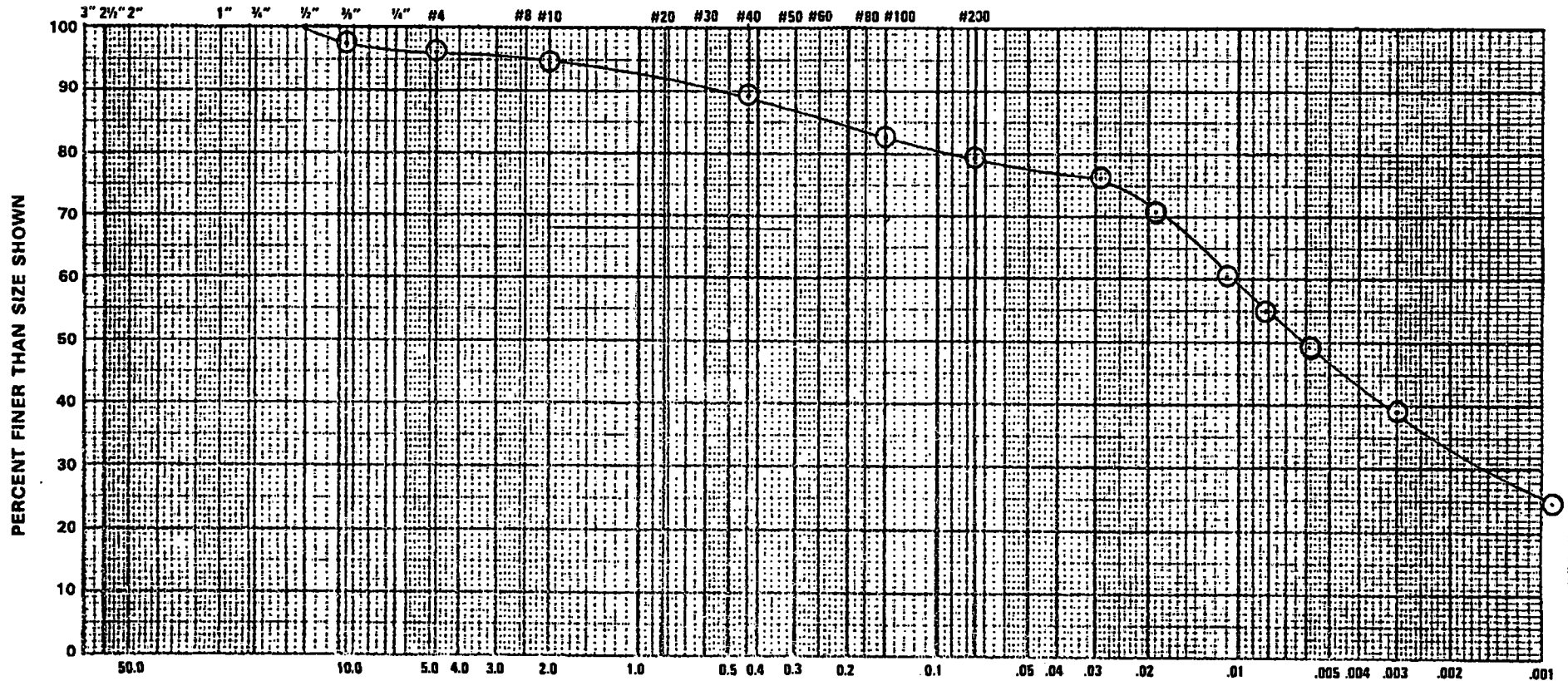
WEIGHT OF TEST SAMPLE 371.7 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1					
¾					
1/2	0	0	100		
3/8	8.5	2.3	97.7		
#4	5.4	1.5	96.2		
10	7.6	2.0	94.2		
40	18.3	4.9	89.3		
100	24.2	6.5	82.8		
200	13.3	3.6	79.2		
PAN	295.0	79.4			

REMARKS:

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



PROJECT: Winthrop Harbor - Slurry Wall Backfill

DATE: 1-16-89

SAMPLE NO. GC-1

LOCATION SAMPLED: STA. 1+00 - Sample #1

ELEV. OR DEPTH:

DRAWN BY: POK

APPROVED BY: RRR

ATTEBERG LIMITS: LL 30.3 PL 14.6 PI 15.7 SAMPLED MOISTURE CONTENT (%): 26.0

COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 4/3

DATE SAMPLED: 12-23-88

SOIL CLASSIFICATION (ASTM: D2487) LEAN CLAY W/SAND, a little gravel, brown to dark brown, (CL)

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES **DRAFT**

PROJECT: Winthrop Harbor
Slurry Wall Backfill

REPORTED TO: BFI - Waste Systems

SCOPE I.D. #: 88B59
DATE TYPED: 1-26-89
REPORT NUMBER: 2

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: STA. 1+96
SAMPLE NUMBER: GC-2
DEPTH OF SAMPLE:
SAMPLED BY: Tim Ambrosius of F&VD

DATE SAMPLED: 12/27/88
DATED RECEIVED: 1/04/89
SOURCE OF SAMPLE:
MUNSELL COLOR CODE: 10 YR. 4/2

LABORATORY DATA:

DATE TESTED: January 6-9, 1989
TESTED PERFORMED BY: KAS
REVIEWED BY: P.O. Kepler 1-9-89

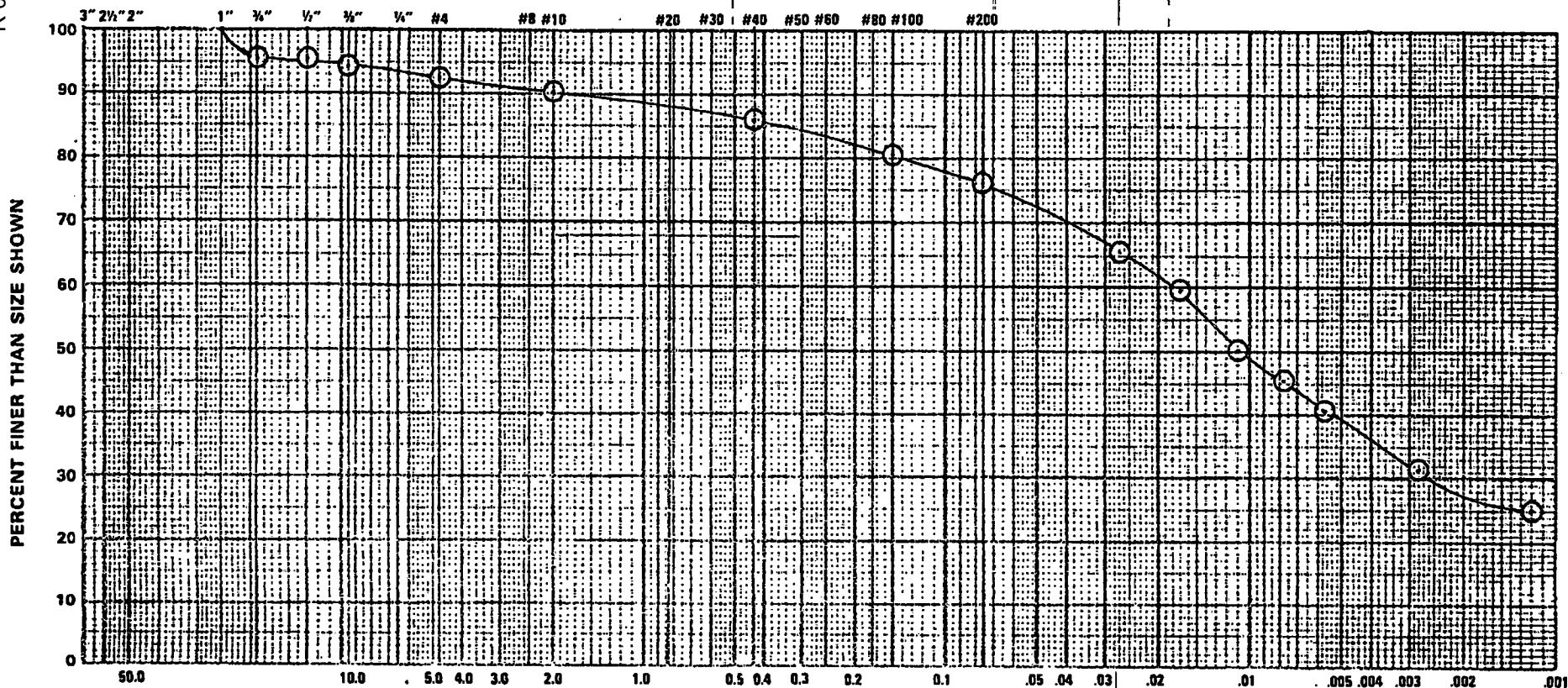
24 HRS. TURN AROUND YES ☒ NO
WASHED GRADATION X YES NO
WEIGHT OF TEST SAMPLE 864.6 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1	0	0	100		
¾	38.5	4.5	95.5		
½	0	0	95.5		
3/8	10.8	1.2	94.3		
#4	15.9	1.8	92.5		
10	18.7	2.2	90.3		
40	37.7	4.4	85.9		
100	46.0	5.3	80.6		
200	39.0	4.5	76.1		
PAN	658.5	76.2			

REMARKS:

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

DRAFT

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

PROJECT: Winthrop Harbor
Slurry Wall Backfill

REPORTED TO: BFI - Waste Systems

SCOPE I.D. #: 88B59

DATE TYPED: 1-26-89

REPORT NUMBER: 3

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: STA. 3+00

SAMPLE NUMBER: GC-3

DEPTH OF SAMPLE:

SAMPLED BY: Tim Ambrosius of F&VD

DATE SAMPLED: 12/29/88

DATED RECEIVED: 1/4/89

SOURCE OF SAMPLE:

MUNSELL COLOR CODE: 10 YR. 4/2

LABORATORY DATA:

DATE TESTED: January 6 - 9, 1989

TESTED PERFORMED BY: KAS

REVIEWED BY: P.O. Kepler 1-9-89

24 HRS. TURN AROUND YES x NO

WASHED GRADATION x YES NO

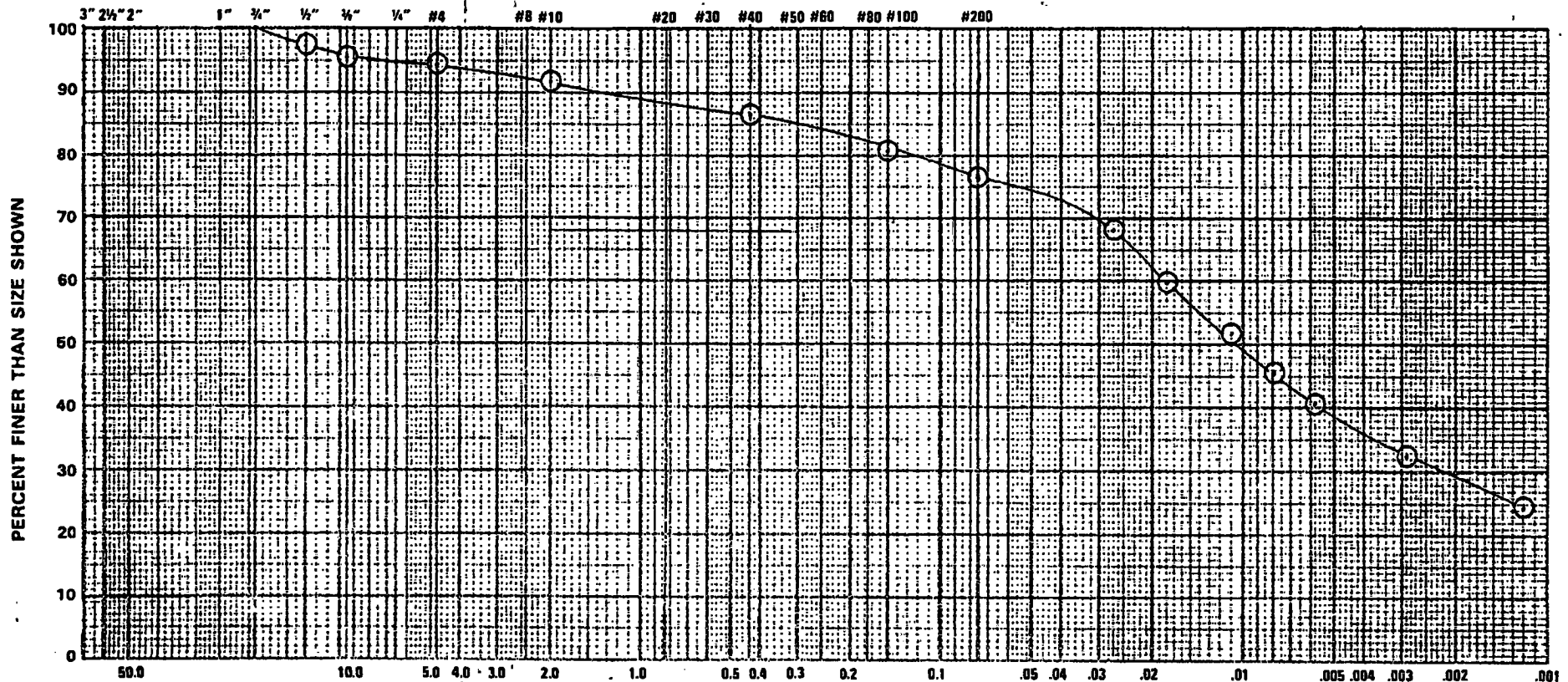
WEIGHT OF TEST SAMPLE 718.6 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1					
¾	0	0	100		
1/2	20.1	2.8	97.2		
3/8	11.6	1.6	95.6		
#4	7.6	1.1	94.5		
10	19.1	2.7	91.8		
40	35.7	5.0	86.8		
100	43.4	6.0	80.8		
200	31.7	4.4	76.4		
PAN	548.8	76.4			

REMARKS:

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



PROJECT: Winthrop Harbor - Slurry Wall Backfill DATE: 1-10-89 SAMPLE NO.: GC-3

LOCATION SAMPLED: Sta. 3+00 Sample No. 3 ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 31.7 PL 15.4 PI 16.3 SAMPLED MOISTURE CONTENT (%): 32.0 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 4/2 DATE SAMPLED: 12-29-88

SOIL CLASSIFICATION (ASTM: D2487) LEAN CLAY W/SAND, a little gravel, dark grayish brown (CL)

DRAFT

Foth & Van Dyke and Associates Inc.
 2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

DRAFT

**REPORT OF:
 SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES**

PROJECT: Winthrop Harbor
 Slurry Wall Backfill
REPORTED TO: BFI - Waste Systems

SCOPE I.D. #: 88B59
DATE TYPED: 1-26-89
REPORT NUMBER: 4

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: STA. 4+00
SAMPLE NUMBER: GC-4
DEPTH OF SAMPLE:
SAMPLED BY: Tim Ambrosius of F&VD

DATE SAMPLED: 12/31/88
DATED RECEIVED: 1/4/89
SOURCE OF SAMPLE:
MUNSELL COLOR CODE: 10 YR. 4/2

LABORATORY DATA:

DATE TESTED: January 6-9, 1989
TESTED PERFORMED BY: KAS
REVIEWED BY: P.O. Kepler 1-9-89

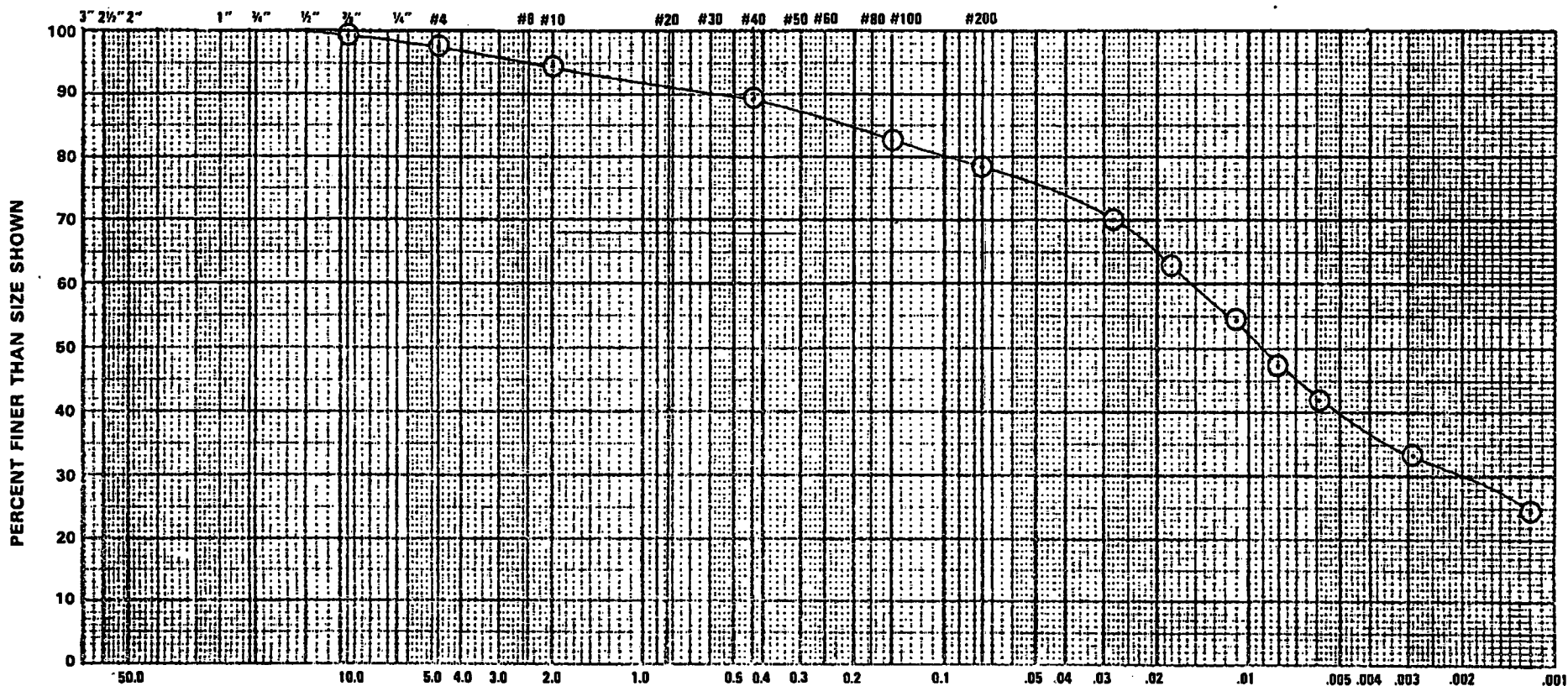
24 HRS. TURN AROUND YES x NO
WASHED GRADATION x YES NO
WEIGHT OF TEST SAMPLE 652.9 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1 1/2"					
1"					
3/4"					
1/2"	0	0	100		
3/8"	2.8	0.4	99.6		
#4	12.4	1.9	97.7		
10	20.0	3.1	94.6		
40	34.8	5.3	89.3		
100	43.0	6.6	82.7		
200	29.0	4.4	78.3		
PAN	510.9	78.3			

REMARKS:*Robert R. Rouse*

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



PROJECT: Winthrop Harbor - Slurry Wall Backfill DATE: 1-10-89 SAMPLE NO.: GC-4

LOCATION SAMPLED: STA. 4+00 - Sample No. 4 ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTEBERG LIMITS: LL 31.4 PL 15.4 PI 16.0 SAMPLED MOISTURE CONTENT (%): 43.5 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 4.2 DATE SAMPLED: 12-31-88

SOIL CLASSIFICATION (ASTM: D2487) LEAN CLAY W/SAND, dark grayish brown (CL)

FORM #411 SL (2/87)

DRAFT

R 00137

Foth & Van Dyke and Associates Inc.
 2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

**REPORT OF:
 SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES**

DRAFT

PROJECT: Winthrop Harbor
 Slurry Wall Backfill
REPORTED TO: BFI - Waste Systems

SCOPE I.D. #: 88B59
DATE TYPED: 1-26-89
REPORT NUMBER: 5

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: STA. 5+00
SAMPLE NUMBER: GC-5
DEPTH OF SAMPLE:
SAMPLED BY: Tim Ambrosius of F&VD

DATE SAMPLED: 1/1/89
DATED RECEIVED: 1/4/89
SOURCE OF SAMPLE:
MUNSELL COLOR CODE: 10 YR. 4/2

LABORATORY DATA:

DATE TESTED: January 6-9, 1989
TESTED PERFORMED BY: KAS
REVIEWED BY: P.O. Kepler 1-9-89

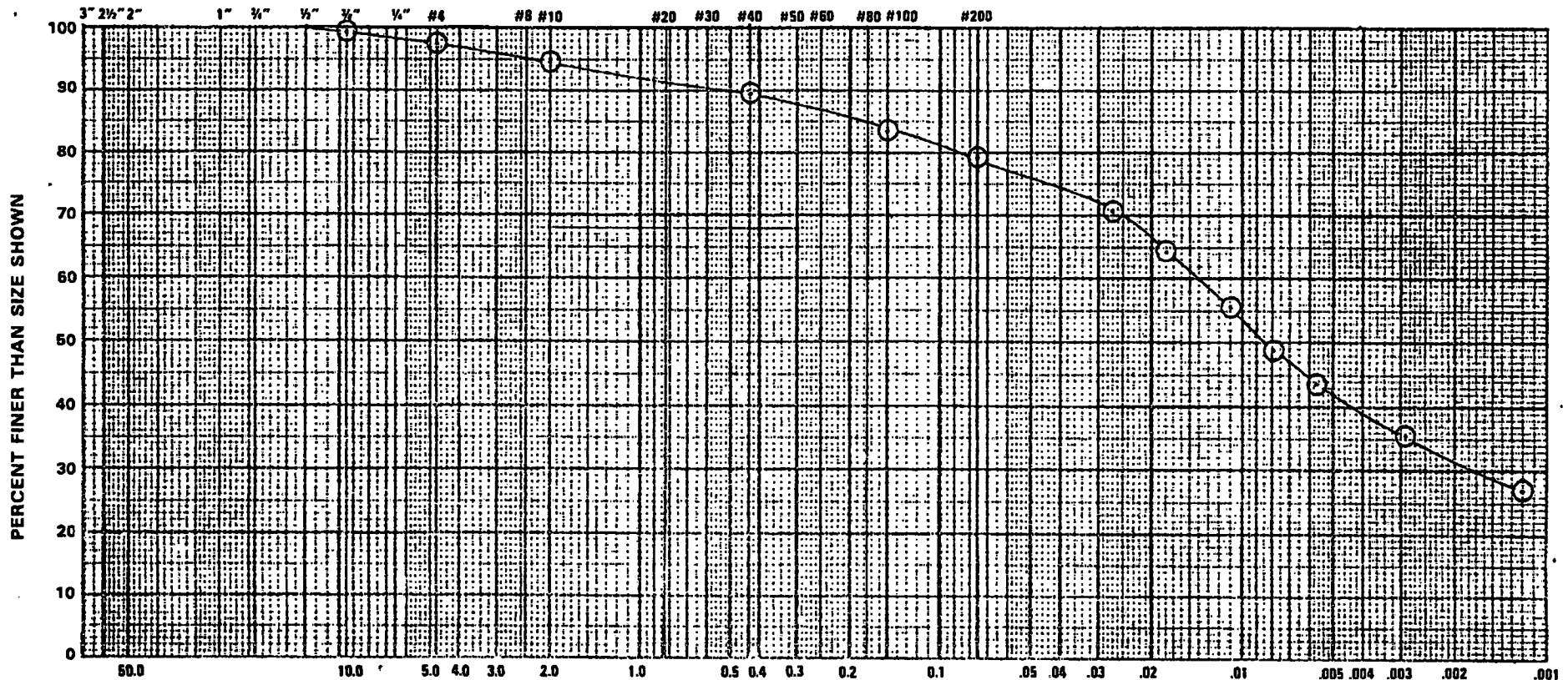
24 HRS. TURN AROUND YES x NO
WASHED GRADATION x YES NO
WEIGHT OF TEST SAMPLE 850.4 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1					
¾					
1/2	0	0	100		
3/8	5.3	0.6	99.4		
#4	16.4	1.9	97.5		
10	23.4	2.8	94.7		
40	43.9	5.2	89.5		
100	53.9	6.3	83.2		
200	35.0	4.1	79.1		
PAN	672.3	79.1			

REMARKS:

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



		PARTICLE SIZE IN MILLIMETERS				
GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 2.5	% = 2.8	% = 5.2	% = 10.4	% = 47.6	% = 31.5

PROJECT: Winthrop Harbor - Slurry Wall Backfill DATE: 1-10-89 SAMPLE NO.: GC-5

LOCATION SAMPLED: STA. 5+00 - Sample No. 5 ELEV. OR DEPTH: _____ DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 33.0 PL 15.6 PI 17.4 SAMPLED MOISTURE CONTENT (%): 38.3 COEFFICIENTS: Cc = _____ Cu = _____

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 10 YR. 4/2 DATE SAMPLED: 1-1-89

SOIL CLASSIFICATION (ASTM: D2487) LEAN CLAY W/SAND, dark grayish brown (CL)

DRAFT

Foth & Van Dyke and Associates Inc.
 2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

DRAFT

REPORT OF:
SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

PROJECT: Winthrop Harbor
 Slurry Wall Backfill

REPORTED TO: BFI - Waste Systems

SCOPE I.D. #: 88B59
DATE TYPED: 1-26-89
REPORT NUMBER: 6

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: STA. 6+00
SAMPLE NUMBER: GC-6
DEPTH OF SAMPLE:
SAMPLED BY: Tim Ambrosius of F&VD

DATE SAMPLED: 1/1/89
DATED RECEIVED: 1/4/89
SOURCE OF SAMPLE:
MUNSELL COLOR CODE: 10 YR. 4/2

LABORATORY DATA:

DATE TESTED: January 6-9, 1989
TESTED PERFORMED BY: KAS
REVIEWED BY: P.O. Kepler 1-9-89

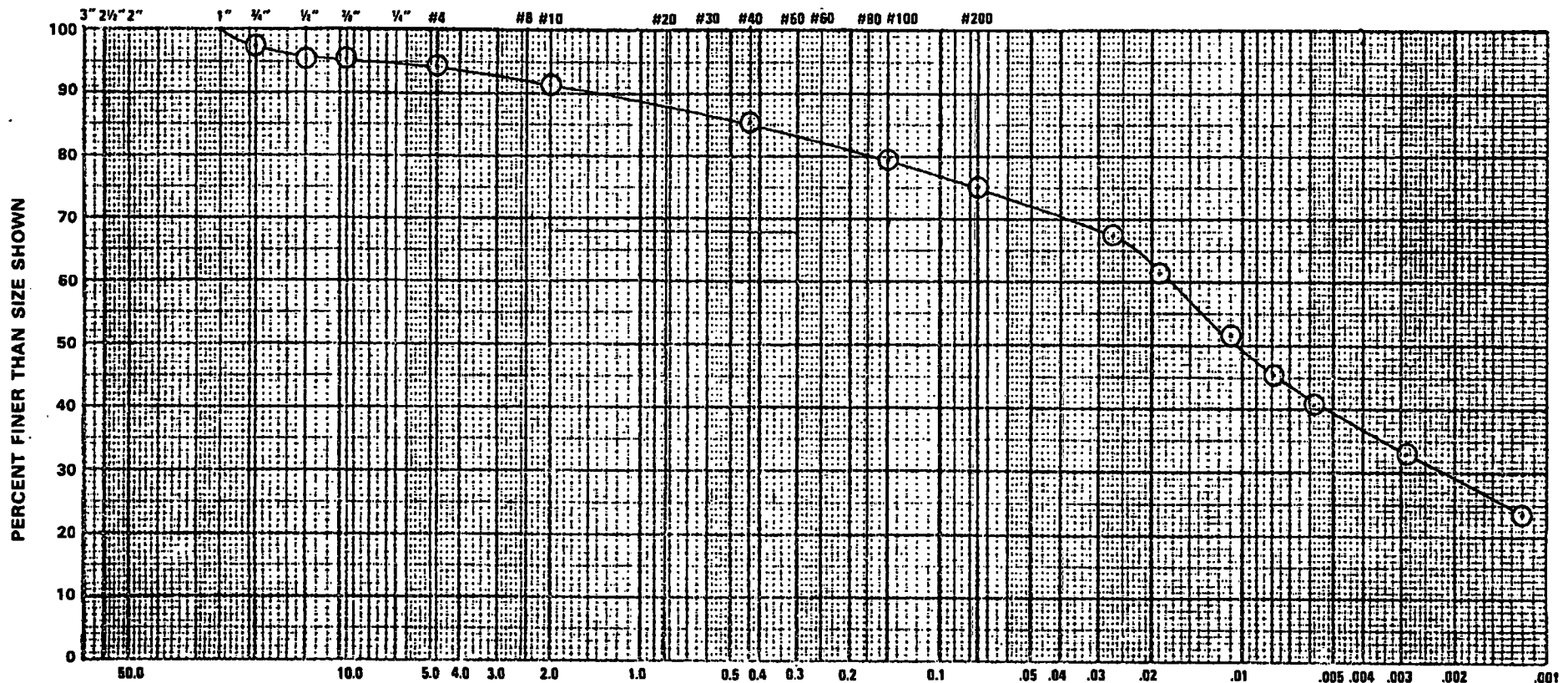
24 HRS. TURN AROUND YES x NO
WASHED GRADATION x YES NO
WEIGHT OF TEST SAMPLE 860.2 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1	0	0	100		
¾	22.3	2.6	97.4		
½	16.2	1.9	95.5		
¾	0	0	95.5		
#4	12.1	1.4	94.1		
10	23.7	2.8	91.3		
40	48.3	5.6	85.7		
100	54.7	6.4	79.3		
200	37.2	4.3	75.0		
PAN	645.6	75.1			

REMARKS:

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 2.6	% = 3.3	% = 2.8	% = 5.6	% = 10.6	% = 45.6	% ≥ 9.5

PROJECT: Winthrop Harbor - Slurry Wall Backfill DATE: 1-10-89 SAMPLE NO.: GC-6

LOCATION SAMPLED: STA. 6+00 - Sample No. 6 ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 32.6 PL 14.8 PI 17.8 SAMPLED MOISTURE CONTENT (%): 38.8 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 4/2 DATE SAMPLED: 1-1-89

SOIL CLASSIFICATION (ASTM: D2487) LEAN CLAY W/SAND, a little gravel, dark grayish brown (CL)

DRAFT

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

DRAFT

PROJECT: Winthrop Harbor
Slurry Wall Backfill

REPORTED TO: BFI- Waste Systems

SCOPE I.D. #: 88B59
DATE TYPED: 1-26-89
REPORT NUMBER: 7

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: STA. 7+00
SAMPLE NUMBER: GC-7
DEPTH OF SAMPLE:
SAMPLED BY: Tim Ambrosius of F&VD

DATE SAMPLED: 1/2/89
DATED RECEIVED: 1/9/89
SOURCE OF SAMPLE:
MUNSELL COLOR CODE: 10 YR. 4/2

LABORATORY DATA:

DATE TESTED: January 11-13, 1989
TESTED PERFORMED BY: KAS
REVIEWED BY: R. Rouse 1-16-89

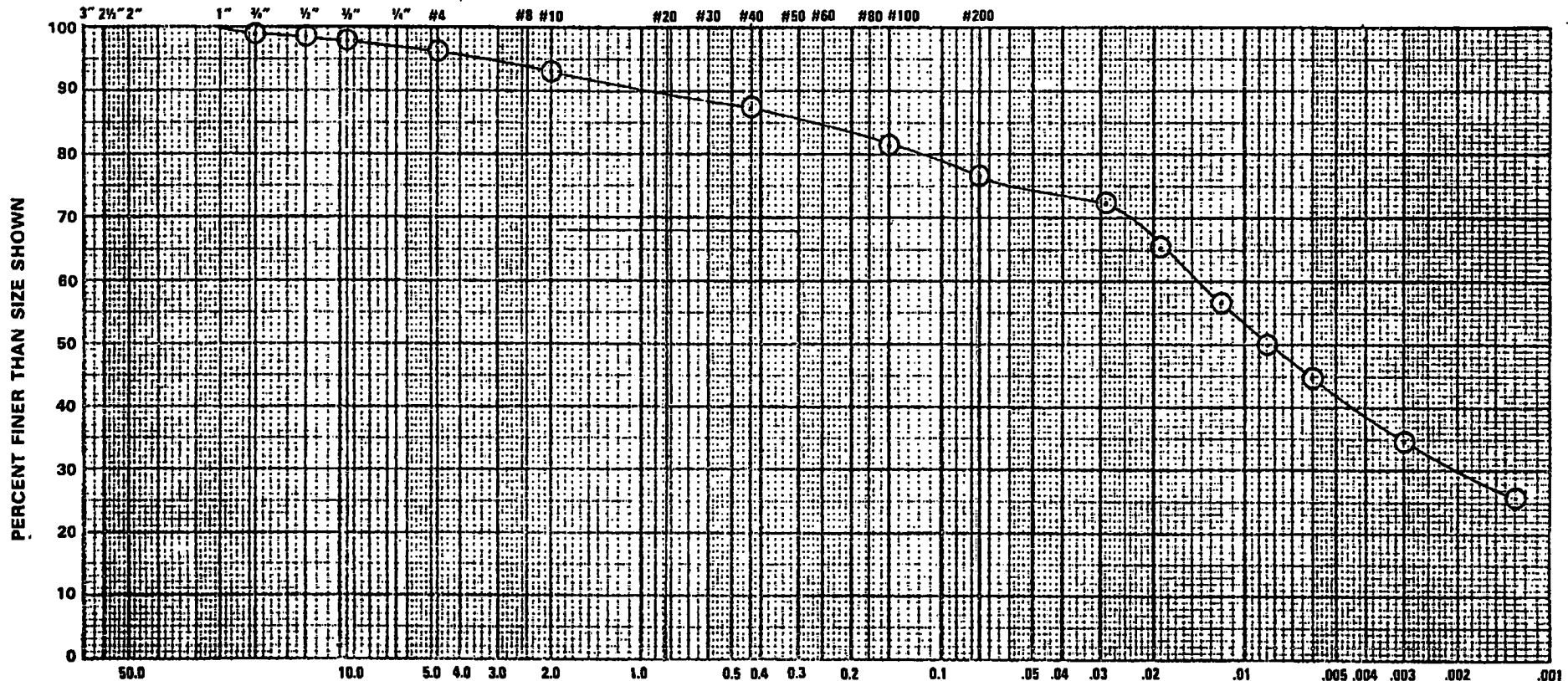
24 HRS. TURN AROUND YES x NO
WASHED GRADATION x YES NO
WEIGHT OF TEST SAMPLE 742.4 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1	0	0	100		
¾	8.2	1.1	98.9		
½	3.0	0.4	98.5		
3/8	4.5	0.6	97.9		
#4	13.9	1.9	96.0		
10	22.1	3.0	93.0		
40	40.6	5.5	87.5		
100	47.0	6.3	81.2		
200	33.1	4.5	76.7		
PAN	570.0	76.8			

REMARKS:

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



PROJECT: Winthrop Harbor - Slurry Wall Backfill

DATE: 1-16-89

SAMPLE NO: GC-7

LOCATION SAMPLED: STA. 7+00 - Sample #7

ELEV. OR DEPTH:

DRAWN BY: POK

APPROVED BY: RRR

ATTERBERG LIMITS: LL 33.1 PL 14.5 PI 18.6

SAMPLED MOISTURE CONTENT (%): 45.6

COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 4/2

DATE SAMPLED: 1-2-89

SOIL CLASSIFICATION (ASTM: D2487) LEAN CLAY W/SAND, a little gravel, dark grayish brown (CL)

FORM #411 SL (12/87)

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

DRAFT

PROJECT: Winthrop Harbor
Slurry Wall Backfill

SCOPE I.D. #: 88B59

DATE TYPED: 1-26-89

REPORTED TO: BFI - Waste Systems

REPORT NUMBER: 8

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: STA. 8+00

DATE SAMPLED: 1/2/89

SAMPLE NUMBER: GC-8

DATED RECEIVED: 1/4/89

DEPTH OF SAMPLE:

SOURCE OF SAMPLE:

SAMPLED BY: Tim Ambrosius of F&VD

MUNSELL COLOR CODE: 10 YR. 4/2

LABORATORY DATA:

DATE TESTED: January 11-13, 1989

24 HRS. TURN AROUND ☐ YES ☒ NO

TESTED PERFORMED BY: KAS

WASHED GRADATION ☒ YES ☐ NO

REVIEWED BY: R. Rouse 1-16-89

WEIGHT OF TEST SAMPLE 651.8 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING
3"			
1½"			
1"			
¾"	0	0	100
½"	3.5	0.5	99.5
¾"	2.1	0.3	99.2
#4	13.2	2.0	97.2
10	20.5	3.1	94.1
40	34.1	5.2	88.9
100	37.8	5.8	83.1
200	26.9	4.1	79.0
PAN	513.7	78.8	

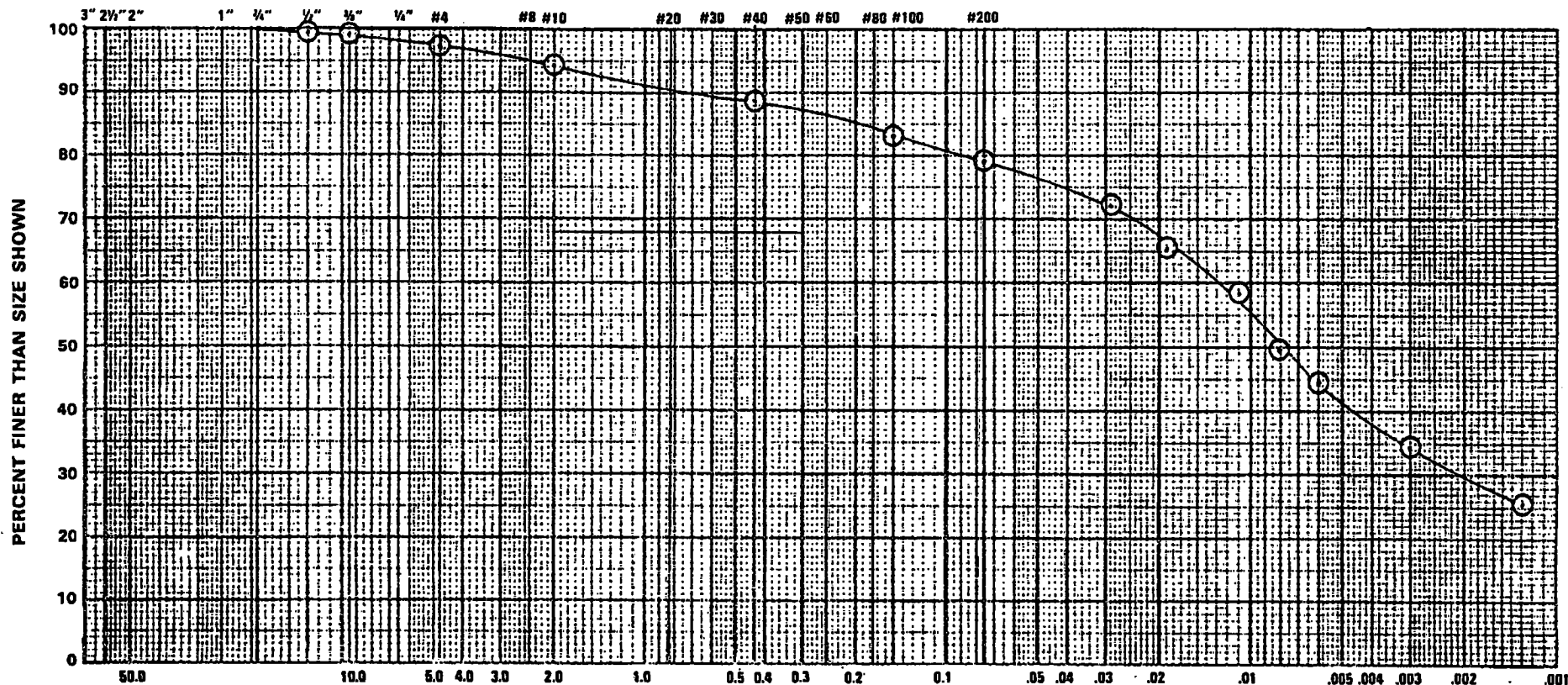
PROJECT SPECIFICATION
% PASSING BY WEIGHT

SOURCE OF SPECIFICATION

REMARKS:

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



		PARTICLE SIZE IN MILLIMETERS				
GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 2.8	% = 3.1	% = 5.2	% = 10.1	% = 49.0	% = 29.8

PROJECT: Winthrop Harbor - Slurry Wall Backfill DATE: 1-16-89 SAMPLE NO.: GC-8

LOCATION SAMPLED: STA. 8+00 - Sample #8 ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 32.2 PL 14.5 PI 17.7 SAMPLED MOISTURE CONTENT (%): 42.9 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 4/2 DATE SAMPLED: 1-3-89

SOIL CLASSIFICATION (ASTM: D2487) LEAN CLAY W/SAND, dark grayish brown (CL)

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

DRAFT

PROJECT: Winthrop Harbor
Slurry Wall Backfill

REPORTED TO: BFI - Waste Systems

SCOPE I.D. #: 88B59
DATE TYPED: 1-26-89
REPORT NUMBER: 9

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: STA. 9+00
SAMPLE NUMBER: GC-9
DEPTH OF SAMPLE:
SAMPLED BY: Tim Ambrosius of F&VD

DATE SAMPLED: 1/3/89
DATED RECEIVED: 1/9/89
SOURCE OF SAMPLE:
MUNSELL COLOR CODE: 10 YR. 4/2

LABORATORY DATA:

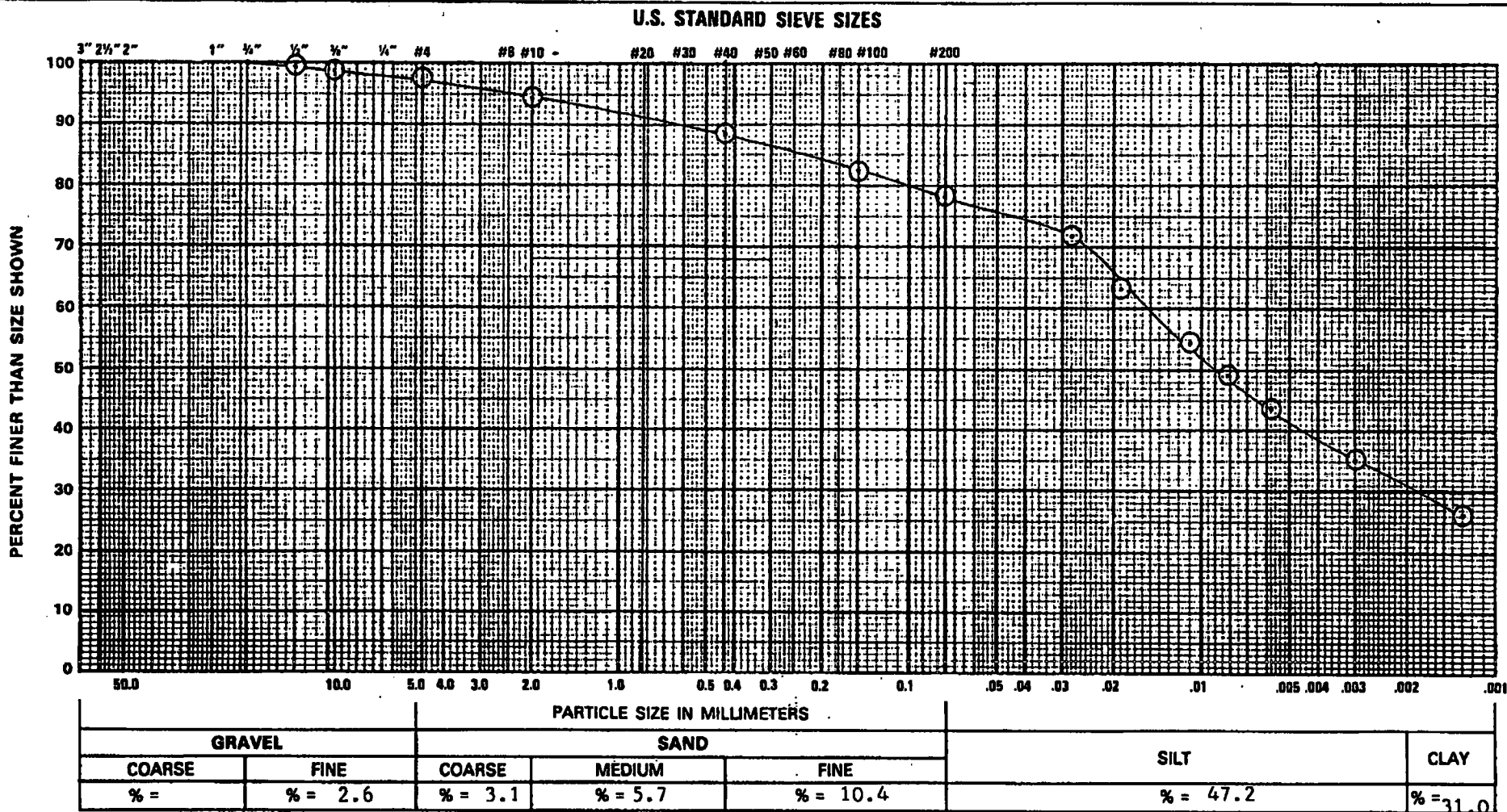
DATE TESTED: January 11-13, 1989
TESTED PERFORMED BY: KAS
REVIEWED BY: R. Rouse 1-16-89

24 HRS. TURN AROUND YES X NO
WASHED GRADATION X YES NO
WEIGHT OF TEST SAMPLE 671.6 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1					
¾	0	0	100		
½	3.3	0.5	99.5		
¾	4.9	0.7	98.8		
#4	9.1	1.4	97.4		
10	20.7	3.1	94.3		
40	38.0	5.7	88.6		
100	42.3	6.3	82.3		
200	28.0	4.2	78.1		
PAN	525.3	78.2			

REMARKS:

GRAIN SIZE DISTRIBUTION CURVE



PROJECT: Winthrop Harbor - Slurry Wall Backfill

DATE: 1-16-89 SAMPLE NO.: GC-9

LOCATION SAMPLED: STA. 9+00 - Sample #9

ELEV. OR DEPTH:

DRAWN BY: POK

APPROVED BY: RRR

ATTERBERG LIMITS: LL 30.5 PL 14.4 PI 16.1 SAMPLED MOISTURE CONTENT (%): 47.5

COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 4/2

DATE SAMPLED: 1-3-89

SOIL CLASSIFICATION (ASTM: D2487) LEAN CLAY W/SAND, dark grayish brown (CL)

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

DRAFT

PROJECT: Winthrop Harbor
Slurry Wall Backfill

SCOPE I.D. #: 88B59

DATE TYPED: 1-26-89

REPORTED TO: BFI - Waste Systems

REPORT NUMBER: 10

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: STA. 10+00

DATE SAMPLED: 1/4/89

SAMPLE NUMBER: GC-10

DATED RECEIVED: 1/9/89

DEPTH OF SAMPLE:

SOURCE OF SAMPLE:

SAMPLED BY: Tim Ambrosius of F&VD

MUNSELL COLOR CODE: 10 YR. 4/2

LABORATORY DATA:

DATE TESTED: January 11-13, 1989

24 HRS. TURN AROUND: ☐ YES ☒ NO

TESTED PERFORMED BY: KAS

WASHED GRADATION ☒ YES ☐ NO

REVIEWED BY: R. Rouse 1-16-89

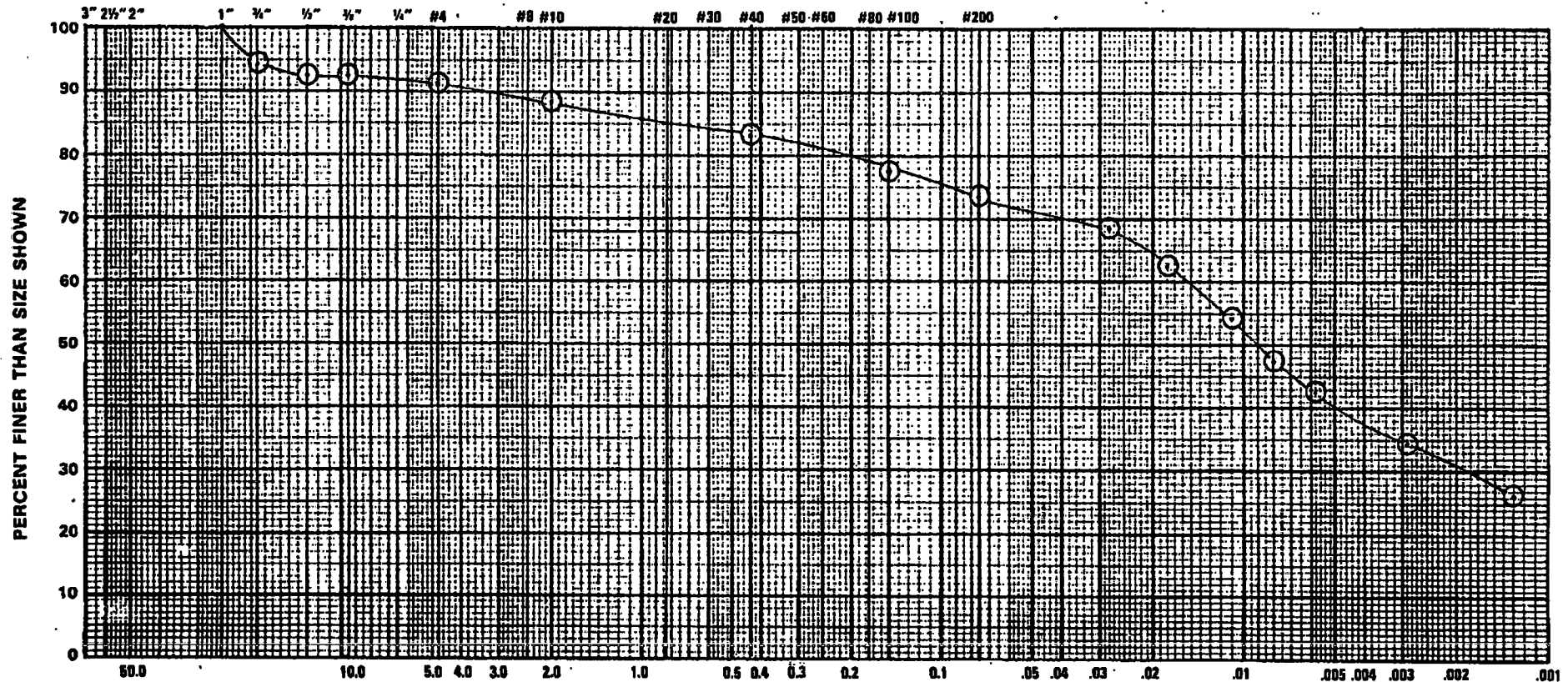
WEIGHT OF TEST SAMPLE 735.6 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1	0	0	100		
3/4	41.9	5.7	94.3		
1/2	11.6	1.6	92.7		
3/8	0	0	92.7		
#4	10.8	1.5	91.2		
10	18.9	2.6	88.6		
40	39.9	5.4	83.2		
100	41.6	5.7	77.5		
200	28.9	3.9	73.6		
PAN	542.0	73.7			

REMARKS:

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 5.7	% = 3.1	% = 2.6	% = 5.4	% = 9.5	% = 42.7	% = 31.0

PROJECT: Winthrop Harbor - Slurry Wall Backfill DATE: 1-16-89 SAMPLE NO.: GC-10

LOCATION SAMPLED: STA. 10+00 - Sample #10 ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 35.2 PL 15.0 PI 20.2 SAMPLED MOISTURE CONTENT (%): 50.7 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 4/2 DATE SAMPLED: 1-4-89

SOIL CLASSIFICATION (ASTM: D2487) LEAN CLAY W/SAND, a little gravel, dark grayish brown (CL)

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

DRAFT

PROJECT: Winthrop Harbor
Slurry Wall Backfill

SCOPE I.D. #: 88B59

DATE TYPED: 1-26-89

REPORTED TO: BFI Waste Systems

REPORT NUMBER: 11

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: STA. 11+50

DATE SAMPLED: 1/4/89

SAMPLE NUMBER: GC-11

DATED RECEIVED: 1/9/89

DEPTH OF SAMPLE:

SOURCE OF SAMPLE:

SAMPLED BY: Tim Ambrosius of F&VD

MUNSELL COLOR CODE: 10 YR. 4/2

LABORATORY DATA:

DATE TESTED: January 11-13, 1989

24 HRS. TURN AROUND YES x NO

TESTED PERFORMED BY: KAS

WASHED GRADATION x YES NO

REVIEWED BY: R. Rouse 1-16-89

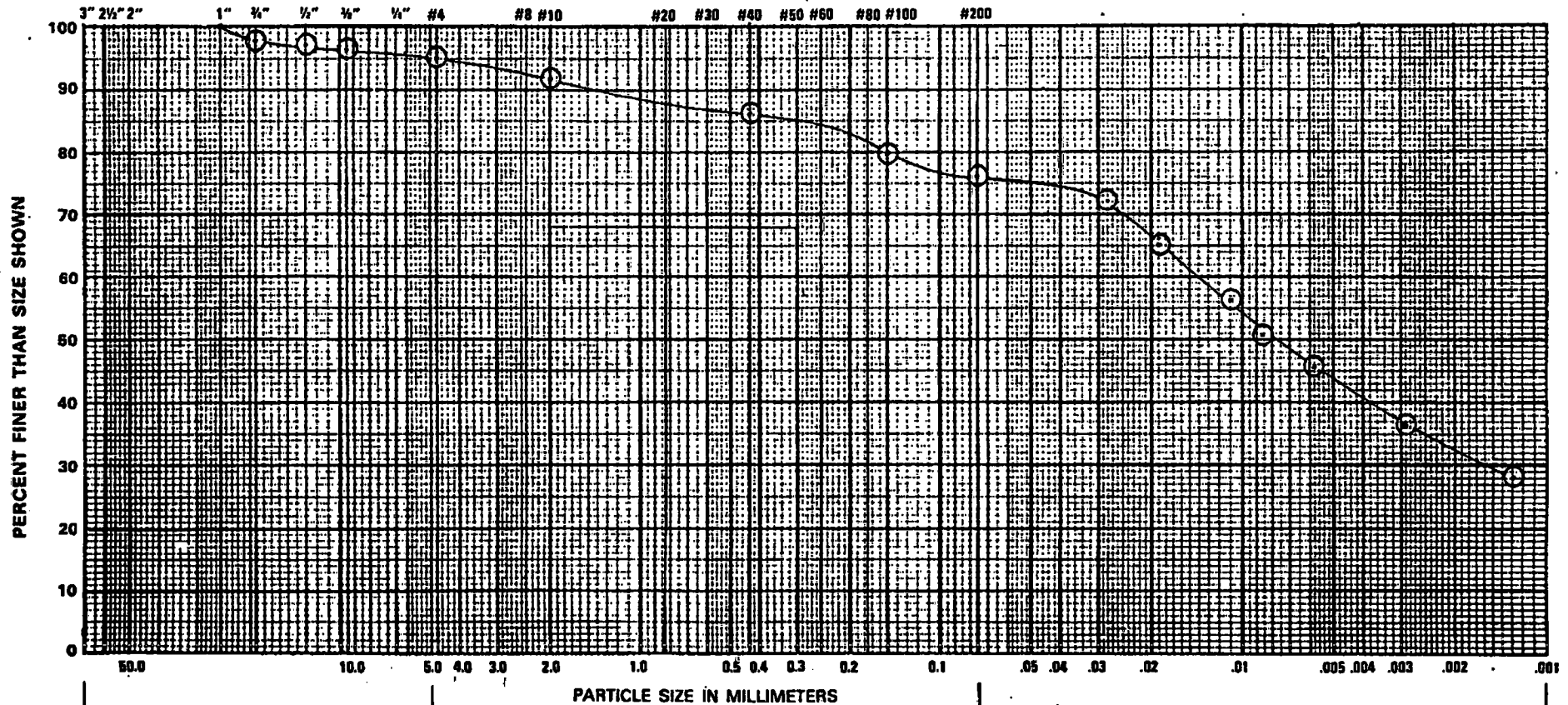
WEIGHT OF TEST SAMPLE 810.8 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1	0	0	100		
¾	17.5	2.2	97.8		
½	5.1	0.6	97.2		
¾	5.4	0.7	96.5		
#4	12.1	1.5	95.0		
10	26.0	3.2	91.8		
40	45.2	5.6	86.2		
100	50.9	6.3	79.9		
200	31.2	3.8	76.1		
PAN	617.4	76.1			

REMARKS:

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



		PARTICLE SIZE IN MILLIMETERS				
GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 2.2	% = 2.8	% = 3.2	% = 5.6	% = 10.1	% = 43.6	% = 32.5

PROJECT: Winthrop Harbor - Slurry Wall Backfill DATE: 1-16-89 SAMPLE NO.: GC-11

LOCATION SAMPLED: STA. 11+50 - Sample #11 ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 36.0 PL 14.9 PI 21.1 SAMPLED MOISTURE CONTENT (%): COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSSELL COLOR CODE: 10 YR. 4/2 DATE SAMPLED: 1-4-89

SOIL CLASSIFICATION (ASTM: D2487) LEAN CLAY W/SAND, a little gravel, dark grayish brown (CL)

FORM #411 SL (2/87)

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

DRAFT

PROJECT: Winthrop Harbor
Slurry Wall Backfill

SCOPE I.D. #: 88B59

DATE TYPED: 1-26-89

REPORTED TO: BFI Waste Systems

REPORT NUMBER: 12

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: STA. 12+00

DATE SAMPLED: 1/6/89

SAMPLE NUMBER: GC-12

DATED RECEIVED: 1/9/89

DEPTH OF SAMPLE:

SOURCE OF SAMPLE:

SAMPLED BY: Tim Ambrosius of F&VD

MUNSELL COLOR CODE: 10 YR. 4/2

LABORATORY DATA:

DATE TESTED: January 11-13, 1989

24 HRS. TURN AROUND YES ☒ NO

TESTED PERFORMED BY: KAS

WASHED GRADATION YES ☒ NO

REVIEWED BY: R. Rouse 1-16-89

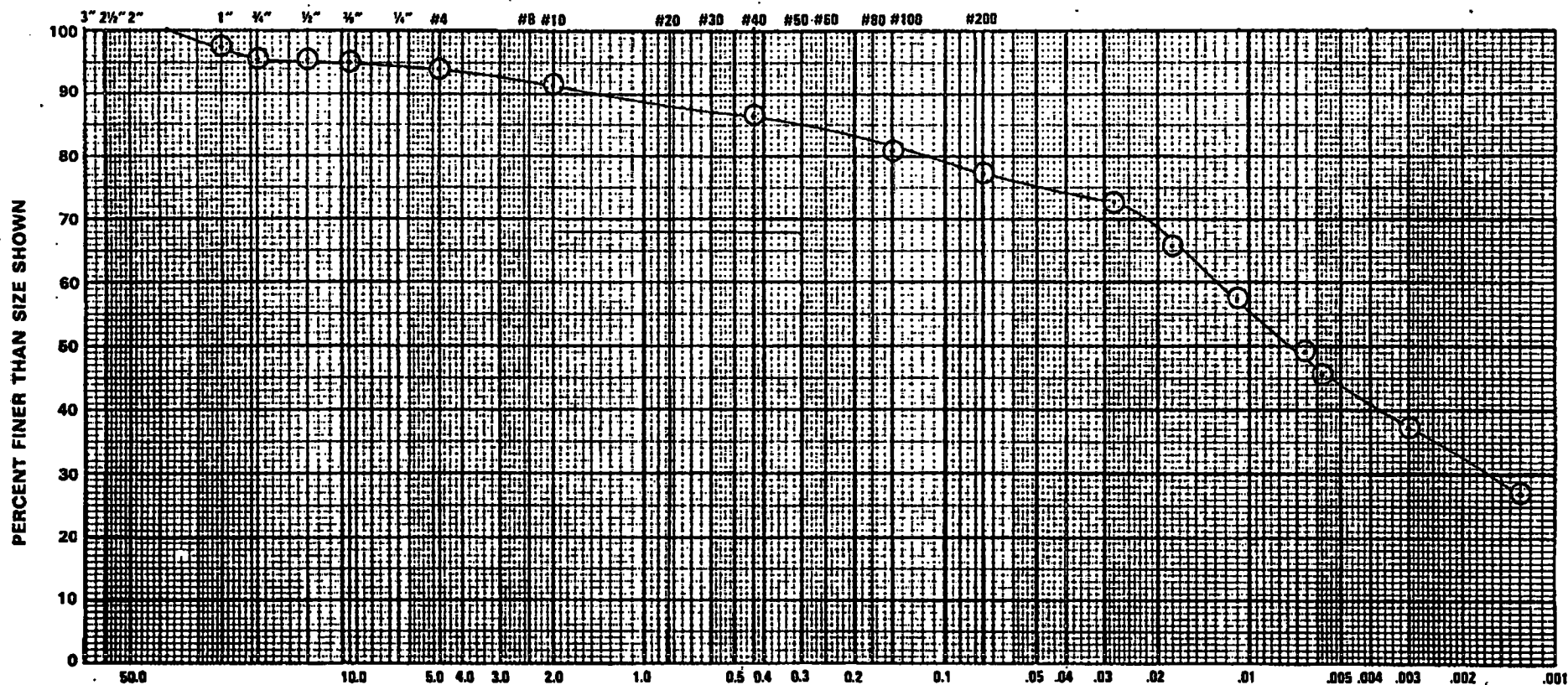
WEIGHT OF TEST SAMPLE 981.8 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½	0	0	100		
1	24.4	2.5	97.5		
¾	21.1	2.1	95.4		
½	0	0	95.4		
3/8	3.8	0.4	95.0		
#4	10.3	1.0	94.0		
10	23.3	2.4	91.6		
40	50.6	5.2	86.4		
100	53.7	5.5	80.9		
200	35.9	3.7	77.2		
PAN	758.7	77.3			

REMARKS:

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



PROJECT: Winthrop Harbor - Slurry Wall Backfill DATE: 1-16-89 SAMPLE NO GC-12

LOCATION SAMPLED: STA. 12+00 - Sample #12 ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 36.3 PL 14.8 PI 21.5 SAMPLED MOISTURE CONTENT (%): 42.7 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 4/2 DATE SAMPLED: 1-6-89

SOIL CLASSIFICATION (ASTM: D2487) LEAN CLAY W/SAND, a little gravel, dark grayish brown (CL)

FORM #411 SL (2/87)

DRAFT

Appendix I

DRAFT

APPENDIX I

Laboratory Permeability Reports



twin city testing
corporation

3908 COMMERCE COURT S.W.
ROCHESTER, MN 55902
PHONE 507/288-7060

January 24, 1989

DRAFT

Foth & Van Dyke
2737 South Ridge Road
Green Bay, WI 54303-9012

Attn: Mr. Robert R. Rouse

Ladies/Gentlemen:

Subj: Laboratory Testing
Slurry Wall Backfill
Winthrop Harbor Project
#4800 89-150

Attached are the results of the permeability tests which were performed on the samples of soil furnished by you as listed in your letter of transmittal dated January 12, 1989.

The permeability specimens were trimmed to the given height and diameter. The specimens were then encased in a latex membrane and placed in a chamber similar to a triaxial chamber. An effective confining pressure of 2.0 psi was applied to seal off the interface between the specimens and membrane.

The remaining portions of the samples will be held at this office for one month and will then be discarded unless we are notified to do otherwise.

The attached data sheet presents pertinent information regarding the test results.

If you have any questions regarding this report or if we can be of any further service to you, please contact us at your convenience.

Very truly yours,

TWIN CITY TESTING CORPORATION

Douglas A. Johnson
Laboratory Supervisor

Enc.

DAJ/brs

PROJECT: WINTHROP HARBOR PROJECT		LABORATORY TEST DATA	
REPORT TO: Foth & Van Dyke		DATE: January 12, 1989 LAB. NO. 4800 89-150	
Sample No.	P1		
Location	STA 1 + 00		
Type of Sample	Thin Wall		
Soil Classification	SLURRY SAMPLE		
In-Place Moisture Content (%)			
Moisture-Density Relation of Soil (ASTM:D698)			
Max. Dry Density (PCF)			
Optimum Moisture Content (%)			
Permeability Test			
Trial No.		5-6	
Type of Test		Falling Head	
Type of Specimen		Undisturbed	
Specimen Height (inches)		1.88	
Specimen Diameter (inches)		2.76	
Dry Density (PCF)		105.8	
Percent of Max. Density		--	
Moisture Content (%)		23.6	
Max. Head Differential (cm)		152	
Confining Pressure (Effective - PSI)		2.0	
Water Temperature (°C)		19	
Coefficient of Permeability K @ 20°C (cm/sec)		3.5 X 10 ⁻⁸	
K @ 20°C (in/min)		6.9 X 10 ⁻⁸	
Atterberg Limits			
Liquid Limit (%)			
Plastic Limit (%)			
Plasticity Index			

DRAFT



PROJECT: WINTHROP HARBOR PROJECT		LABORATORY TEST DATA		
REPORT TO: Foth & Van Dyke		DATE: January 24, 1989 LAB. NO. 4800 89-150		
Sample No.	P2	P3	P4	
Location	STA 3 + 00 Slurry Wall Backfill	STA 7 + 00 Slurry Wall Backfill	STA 11 + 00 Slurry Wall Backfill	
Type of Sample	Thin Wall	Thin Wall	Thin Wall	
Soil Classification	FILL	FILL	FILL	
In-Place Moisture Content (%)				
Moisture-Density Relation of Soil (ASTM:D698)				
Max. Dry Density (PCF)				
Optimum Moisture Content (%)				
Permeability Test				
Trial No.	5-6	5-6	5-6	
Type of Test	Falling Head	Falling Head	Falling Head	
Type of Specimen	Undisturbed	Undisturbed	Undisturbed	
Specimen Height (inches)	2.06	1.87	1.79	
Specimen Diameter (inches)	2.76	2.84	2.85	
Dry Density (PCF)	114.6	113.7	98	
Percent of Max. Density	-	-	-	
Moisture Content (%)	17.4	19.6	28.0	
Max. Head Differential (cm)	152.0	152.0	152.0	
Confining Pressure (Effective - PSI)	2.0	2.0	2.0	
Water Temperature (°C)	19	19	19	
Coefficient of Permeability K @ 20°C (cm/sec)	2.8 X 10 ⁻⁸	1.1 X 10 ⁻⁸	3.3 X 10 ⁻⁸	
K @ 20°C (in/min)	5.5 X 10 ⁻⁸	2.2 X 10 ⁻⁸	6.5 X 10 ⁻⁸	
Atterberg Limits				
Liquid Limit (%)				
Plastic Limit (%)				
Plasticity Index				

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TWIN CITY TESTING
CORPORATION

Appendix E-3G

Construction Observation Report, Slurry Trench Cutoff Wall, January 1991

CONSTRUCTION OBSERVATION REPORT
FOR THE
SLURRY TRENCH CUTOFF WALL
ZION WASTE MANAGEMENT FACILITY
ZION, ILLINOIS

Prepared for:
BROWNING-FERRIS INDUSTRIES OF ILLINOIS, INC.
1827 Walden Office Square, Suite 107
Schaumburg, Illinois 60173

Prepared by:
MC DONALD - MAAS ASSOCIATES
100 East Mason Street
P.O. Box 11507
Green Bay, Wisconsin 54307-1507

JANUARY, 1991

Documentation Statement

This construction documentation report (and accompanying record drawings) was prepared based on our observations, surveys, in-field soil analyses, laboratory soil analyses, photographs, and information provided by the contractor and Browning-Ferris Industries. It is our opinion that, to the extent that construction was observed and tested, the Slurry Trench Cutoff Wall construction segment described in this report at the Zion Waste Management Facility has been completed in substantial conformance with the general intent of the project and the project specifications.

This statement is made based upon an understanding that the recommendations contained in this report will be brought to a timely and successful conclusion.

Timothy J. Ambrosius
Timothy J. Ambrosius
Resident Project Manager

19 January, 1991
Date

James J. McDonald
James J. McDonald, P.E.
Project Manager

19 January, 1991
Date

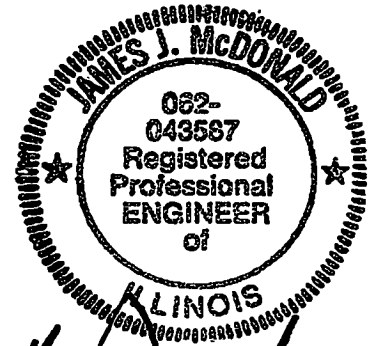


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1.0 INTRODUCTION

1.1 General Site Information

The Zion Waste Management Facility is located in the NW 1/4 of Section 7, Township 46N, Range 12E, Lake County, Illinois. The site is bordered on the west by Green Bay Road and on the south by Ninth Street. The facility is owned and operated by Browning-Ferris Industries of Illinois, Inc. (BFI) and is used for disposal of municipal solid waste products.

1.2 Project History

The total Zion Waste Management Facility property encompasses approximately 150-acres. Of the total, 74.53-acres are used for management of RCRA Hazardous Waste and are subject to the permit issued by the Illinois Environmental Protection Agency (IEPA). These 74.53-acres are designated by the IEPA as Zion Waste Management Site No. 1, IEPA ID No. 0978020001 and the United States Environmental Protection Agency (USEPA) ILD No. 980700728. The remaining 75-acres are used for the disposal of nonhazardous waste disposal and are designated by the IEPA as Zion Waste Management Site No. 2, IEPA ID No. 0978020002.

Zion Waste Management Site No. 1 received a development permit in August of 1976 from the IEPA. That permit allowed for the disposal of municipal, commercial, industrial, and hazardous waste in a 59-acre area in Benton Township and a 16-acre area in Newport Township. The 16-acres of the permitted Zion Waste Management Site No. 1 located in Newport Township are currently used for ancillary facilities. The Existing Hazardous Waste Management Unit, a 49-acre portion of the 59-acres in Benton Township, has been in use since August 1976 as a disposal area for municipal, commercial, and industrial wastes, including hazardous wastes. The existing Hazardous Waste Management Unit received RCRA hazardous waste and a limited amount of nonhazardous industrial waste (IEPA "special waste"). The existing Hazardous Waste Management Unit accepted mainly sludges from electroplating operations and other sludges that were defined as hazardous based on their heavy metal content.

As of July 1990 it was announced by BFI that hazardous wastes would no longer be accepted at any site owned and operated by BFI. This halted the construction of two proposed cells located on the 16-acre portion of the Zion Waste Management Site No. 1 in Newton Township.

1.3 Purpose and Scope

This report and accompanying drawings, Drawing Number 1 and 2, summarize the observations made relative to the second phase of slurry trench cutoff wall construction activities at the Zion Waste Management Facility. Construction of the slurry trench cutoff wall was performed by Ground Improvement Techniques, Inc. (GIT) of Pittsburgh, Pennsylvania. Construction observation was performed by Mc Donald - Maas Associates of Green Bay, Wisconsin. The slurry trench cutoff wall is located just east of the existing Hazardous Waste Management Unit and north of Ninth Street. The primary purpose of the slurry trench cutoff wall is to cut off sand seams in the existing soils along the east and south sections of the Hazardous Waste Management Unit.

The report and drawings are prepared to demonstrate that construction was completed in substantial compliance with the design. The report includes trench slurry test results, backfill test results, photo documentation, and visual classification of the key-in material for the wall. The drawings depict conditions encountered during the construction of this phase of the slurry trench cutoff wall.

2.0 DESIGN AND QUALITY ASSURANCE MANUAL

GIT prepared and submitted the slurry trench cutoff wall mix design for the construction of the second phase of the slurry trench cutoff wall at the Zion Waste Management Facility to Mc Donald - Maas Associates. Based on previous construction experience of Mc Donald - Maas Associates staff members, gained from the first phase of the cutoff wall design and construction, the submitted mix design was approved. The mix design substantially followed the design that was successful in the first phase of the slurry wall construction on this site.

Appendix A contains a copy of the design mix by GIT.

Appendix B contains the Resident Engineer's Quality Assurance Manual.

3.0 SLURRY TRENCH CUTOFF WALL CONSTRUCTION

3.1 Pre-Excavation Activities

A construction pad was constructed by BFI. Clay material used in the construction of the pad was hauled from an on-site borrow pit using Cat 627 self-propelled scrapers. The clay was compacted using a Cat 815 self-propelled sheepsfoot compactor in lifts no greater than 12 inches in thickness prior to compaction. The top of the construction pad was constructed such that it had a slight slope to the west, dropping approximately 0.1 feet for every 10 feet of trench. The top of the construction pad had elevations ranging from 742.9 to 735.3 feet mean sea level (MSL). The elevations of the construction pad are detailed in Table No. 3.1.

Vertical survey control was provided by BFI. The slurry trench cutoff wall horizontal alignment was established using the approximate centerline of the in-place construction pad and staked by the on-site resident engineer. The horizontal alignment maintained a minimum separation distance of 10 feet from all monitoring wells. The slurry trench cutoff wall location is shown on Drawing No. 1 contained in Appendix C.

A construction offset line was used to control horizontal alignment of the slurry trench cutoff wall during construction. The offset line paralleled the wall at a distance of 40 feet east of the center line of the cutoff wall from station 25+05 to station 21+75. The offset line along Ninth Street paralleled the fence at a distance of approximately 30 feet north of the fence, from station 21+75 to station 14+30. The offset line was staked every 100 feet by placing a hub and lath, with an elevation provided on each hub. The center line of the slurry trench cutoff wall was also staked.

The benchmark used for vertical control on this project was the top of the stainless steel monitoring well G-133 (elevation = 754.67 feet MSL). The centerline of the wall was shot every one hundred feet along the top of the pad prior to construction.

3.2 Discussion of Excavation Activities

3.2.1 General

Ground Improvement Techniques, Inc. mobilized to the site on November 5, 1990. The slurry mixer was set up, leveled and balanced near the southwest corner of the wall. High density polyethylene (HDPE) piping was heat fused together and strung from the mixer to the start of the slurry cutoff wall at station 25+05. A pump was set up at the mixer to pump the slurry to the slurry wall cutoff trench. The pump and piping layout allowed for a return line back to the mixer for recirculation of the slurry, when construction conditions did not require slurry.

A second six inch diameter pump was set at the water source with a four inch diameter HDPE pipe extending to the slurry mixer. The existing water pond, which served as the water source, was located in the southwest corner of the facility (near the corner of Ninth Street and Green Bay Road). An additional HDPE line was placed to allow for recirculation of excess water back to the water source.

3.2.2 Bentonite Slurry

To obtain a thoroughly mixed bentonite-water slurry, the bentonite powder and water was mixed with a slurry mixer. This method of mixing was used to achieve complete dispersion of the bentonite particles in the water. The bentonite content of the slurry was a minimum of four percent by weight of water. The bentonite was a pulverized, premium grade natural sodium bentonite and met API specification 13A. The water obtained from an on-site holding pond was practically neutral with a ph value of 7.8. The use of this water was approved by the on-site engineer.

3.2.3 Trench Excavation

The contractor began excavation for the slurry trench cutoff wall on November 10, 1990. A lead-in trench was started approximately 50 feet north of station 25+05 and also 30 feet east of the trench centerline. The lead-in trench totalled 80 feet in length. The trench had a gradual slope from the top of the construction pad to the start of the wall key-in. Bentonite-water slurry was introduced into the lead-in trench once the trench depth reached six (6) feet. The bentonite-water slurry was maintained at a depth of

approximately two feet from the top of the construction pad throughout the entire excavation process.

The trench was excavated vertically from the construction pad to varying depths in order to provide a key of at least three feet into the predetermined underlying native low permeable clay layer. The bottom of the slurry trench cutoff wall was maintained at a maximum elevation of 717.0 feet above mean sea level. The slurry trench cutoff wall was excavated in a continuous fashion using a Cat 245 backhoe, with a three foot wide bucket. The vertical alignment did not deviate from plumb by more than three percent. This was checked by setting a surveyors transit on the unexcavated trench centerline and comparing the boom of the backhoe to the vertical hairs of the transit. The total length of the slurry cutoff wall was 1180 feet. The depth of the slurry cutoff wall ranged from 32.0 to 19.5 feet with an average depth of 24.9 feet.

The top of the predetermined low permeability clay soil layer encountered was well above the 720.0 foot MSL elevation (717.0 + 3 feet of key). The contractor excavated the trench to a depth where the bottom of the key would be at or below the 717.0 foot elevation. A weighted reinforced cloth tape was used to monitor the trench bottom elevation. The tape measurements were used to determine the elevation of the bottom of the excavation. The measurements taken are shown in Table No. 3.1.

Samples of the key material were taken as construction progressed. Sampling and testing of the key material are described in Section 3.6.1.

The slurry trench cutoff wall horizontal alignment was monitored during construction and substantially maintained the preconstruction staked alignment. On the east side, from station 25+05 to station 21+75, the slurry trench cutoff wall paralleled the property line. A distance of 6 feet separated the wall centerline from the property line. The wall was located to the west of the property line.

On the south side, from station 21+75 to station 14+30, the cutoff wall followed a straight alignment approximately 33 feet north of the power poles along Ninth Street. A newly drilled monitoring well is located at station 18+35. The separation distance between the cutoff wall centerline and the well was 12 feet. A minimum separation distance of ten feet from any monitoring wells was specified in the contract.

At station 14+30 the trench excavation was curved such that it would tie into the existing cutoff wall at station 13+25. The radius of the cutoff wall was 57 feet measured from the utility pole at the storage tank.

At the tie-in of the newly constructed slurry trench cutoff wall to the existing cutoff wall, a very small amount of refuse was encountered. The refuse was found 8 feet below the ground elevation at station 13+25. The refuse seam was approximately 4 feet thick. It was excavated from the trench and hauled away for disposal by BFI personnel. An estimated quantity of refuse encountered was approximately 25 cubic yards.

3.3 Discussion of Backfill Methods

The backfilling operation commenced on November 10, 1990. The slurry trench cutoff wall backfill material was placed into the trench after excavation. The backfill material consisted of excavated material, dry bentonite and both trench slurry and freshly mixed slurry.

In order to monitor the quality of the backfill material field sieve analyses were conducted on the backfill material to document the amount of fine material passing the 200 sieve.

The backfill mix design required a minimum of 50.0 percent fines (P-200). The mix design stated that dry bentonite was to be added at a rate of one percent by dry weight of soil to that of the excavated material. The bentonite used was a Wyoming Bentonite and arrived at the site packaged on pallets containing forty (40) one hundred pound bags (2 tons per pallet). The bags of bentonite were broken in the bucket of a Cat 973 crawler loader and placed into the backfill material prior to blending. The dry bentonite was added at a rate of two pallets for every 100 feet of trench.

The blending of the mixture was performed by both a Cat D8 dozer and a Cat D5 dozer in such a manner that the backfill material became homogeneous. The backfill material, prior to placement had a consistency of wet concrete with a slump of four to six inches as determined by the method specified in ASTM C143-78. The blended backfill was sampled routinely and tested in the field to document that its total unit weight was at a minimum 20 pounds per cubic foot (pcf) heavier than that of the bentonite-water slurry.

The initial backfill was placed in the trench starting at the lead-in trench. The total length of the lead-in trench was approximately 80 feet. The trench extended 50 feet to the north of station 25+05 and an additional 30 feet to the east. The lead-in trench started from the ground elevation and gradually sloped to the start of the required wall depth at station 25+05.

Backfill material was placed from the lead-in trench and placed such that its surface rose above the slurry level. This process is known as "daylighting" of the backfill. The dozers filled the trench with the homogeneous backfill from the daylight end. By filling at the daylight end the backfill material was allowed to slowly slide forward down the backfill slope displacing the bentonite-water slurry as it progressed.

By allowing the backfill to slide forward down the backfill slope, the cutoff wall would be homogeneous without voids. The bottom toe of the backfill was 50 to 150 feet from the point of excavation. The backfill slope was monitored daily. The backfill slope measurements are listed in Table 3.4 along with all other backfill data. Having the toe of the slope remain at least 50 feet behind the excavation allowed for sufficient time for inspection of the trench bottom by both the contractor and the resident engineer.

The blended backfill had a sufficient plasticity to allow a rolling of 1/8" thread in accordance with procedures in ASTM D4318.

Backfill surface profile measurements within the trench were conducted daily to verify the slope of backfill being placed into the trench. This was done by measuring the depth to the backfill surface along the construction pad at various intervals and locating the location of the toe. The slope of backfill was found to vary from 3H:1V to 10.5H:1V.

During the backfilling process, the bentonite-water slurry was displaced, therefore, an area was required to hold the spent bentonite-water slurry until disposal could occur. Temporary berms were constructed in the southeast corner of the proposed secure cell No. 2. The bentonite-water slurry was diverted from the trench to the holding area as the backfilling operation proceeded. The spent bentonite-water slurry was contained in the temporary holding pond awaiting disposal by BFI.

3.4 Documentation

The resident engineer was on site throughout the construction process, documenting the various phases of the work. Photographs are contained in Appendix D showing the major aspects of construction. Daily reports by the on-site resident engineer are found in Appendix E. The contractor supplied a written statement concerning the type of bentonite used for this project, a copy of which is contained in Appendix F.

3.5 Miscellaneous Items

3.5.1 Refuse Removal

A small seam of refuse was encountered at station 13+25 while making a tie into the existing slurry cutoff wall. As stated earlier, approximately 25 cubic yards of refuse was removed at the tie-in point. The thickness of the refuse seam encountered during excavation was four feet. All refuse was removed and properly disposed of by BFI personnel.

3.6 Discussion of Testing and Summary of Results

3.6.1 Key Material Sampling and Testing

The cuttings from the key were examined by the resident engineer on a continuous basis to document that the key was excavated into the native low permeability clay layer.

Samples of the key material were collected at 100-foot intervals to verify the properties of the clay layer into which the slurry wall was being keyed. These samples were delivered to and kept at the soils laboratory until they could be analyzed. The soil lab classified the samples as a dark gray lean clay with little sand and gravel (CL). See Table No. 3-1 for Visual Classification of Key-In Material. Additional testing of the key-in material was also conducted on a few of the collected samples in order to further verify the quality of the key-in material. These results are presented in Table No. 3.5. Appendix G contains all laboratory testing results for the key-in material.

3.6.2 Slurry Sampling and Testing

GIT personnel performed quality assurance testing on the trench slurry. The on-site resident engineer performed additional quality assurance tests and also monitored the testing by GIT personnel. The specified properties/requirements are given below:

- . Bentonite content shall be a minimum of four percent by weight of water.
- . Freshly mixed, and fully hydrated, bentonite-water slurry must have a minimum viscosity of 40 Marsh seconds.

- . The bentonite-water slurry shall not lose more than 15 cm of fluid during the performance of the Standard Filter Press Test in accordance with API Specification RP13B at 100 psi applied for a 30-minute duration.
- . Slurry introduced into the trench shall have a minimum density of not less than 63.5 pcf.

The trench slurry was sampled at three different locations in order to verify its consistency. The first location was at the mixer. The second at the end of the pipe, and the third was from the trench itself. All locations were sampled three times per day, if a full day of construction occurred or if trench slurry from the trench was required. See Table 3.2 for testing frequency. Testing results for the slurry from the mixer, the pipe and the trench are summarized in Table No. 3.3. Based on the review of the testing performed in the field on the trench slurry and the testing results shown in Table Nos. 3.2 and 3.3, it is determined that the test results substantially satisfy the specifications.

3.6.3 Backfill Sampling and Testing

Quality assurance testing on backfill material was performed by both GIT and the on-site resident engineer. All tests conducted by GIT were monitored by the on-site resident engineer.

Backfill samples were obtained every 100 feet and tested for grain size and Atterberg Limits at the soils laboratory. These samples were numbered WH-BF-1 to WH-BF-11. A ten pound bag sample was obtained at each of the locations. A shelly tube was also obtained at each 200 feet of trench backfill. From the shelly tube material, dry density, moisture contents, and coefficient of permeability were determined. The required coefficient of permeability was 1.0×10^{-7} cm/sec. or less. The laboratory test results are summarized in Table No. 3.6. and Table No. 3.7.

Quality assurance procedures for the backfill were also conducted daily in the field. The backfill was checked for slump per ASTM C143-79. A slump of four to six inches was specified to approximate the consistency of wet concrete. In addition in-field fines content (P-200) were monitored daily. Appendix H contains all laboratory test results on the backfill material.

4.0 REMAINING CONSTRUCTION ACTIVITIES

With the completion of the cutoff wall, a number of items yet remain, which require attention.

4.1 Site Cleanup

Debris, including spills of trench slurry, and excess spoil materials need to be disposed of in a proper fashion. The temporary holding pond which contained the spent trench slurry should be restored to its original condition. The spent trench slurry also needs to be disposed of properly.

4.2 Pad Removal and Capping

The construction area must be cut such that a protective soil layer can be placed over the top of the newly constructed slurry trench cutoff wall. BFI personnel are presently in the process of starting to cap the cutoff wall. A drainage ditch must also be constructed such that drainage from the east end of the site may be directed to the sedimentation ponds on the far west side of the facility.

4.3 Perimeter Ditch

Prior to construction of the cutoff wall, the perimeter drainage ditch along Ninth Street was filled in (during the construction of the work pad). The perimeter ditch remains to be reshaped to accommodate site drainage to the sedimentation pond.

5.0 CONCLUSIONS

Based upon our observations, surveys, photographs, information provided by the contractor and BFI, and soil laboratory results, it is our opinion that, to the extent that construction was observed and tested, the segment of slurry cutoff wall construction at the Zion Waste Management Facility described in this report has been constructed in substantial compliance with the project concepts and design specifications.

This statement is made with the assumption that recommendations contained in Section 4 of this report are brought to a successful conclusion.

TABLE 3.1

**Visual Classification of Key-In Material
Zion Waste Management Facility**

Station	Clay Pad Elev.	Top of Key	Bottom of Key	Top of Clay	Sample No.
25+05	742.3	719.3	716.3	734.3	WH-KEY-01
24+90	742.3	719.3	716.3		
24+80	742.3	719.3	716.3		
24+70	742.4	718.3	715.3		
24+60	742.1	719.6	716.6		
24+50	742.1	719.6	716.6	733.0	WH-KEY-02
24+40	742.1	719.1	716.1		
24+30	741.7	716.7	713.7		
24+20	741.6	715.6	712.6		
24+10	741.4	718.4	715.4		
24+00	741.0	718.0	715.0		
23+90	740.6	717.6	714.6		
23+80	740.5	718.5	715.5		
23+70	740.4	719.4	716.4		
23+60	740.4	719.4	716.4		
23+50	740.3	717.8	714.8		
23+40	740.2	718.2	715.2		
23+30	740.3	717.8	714.8		
23+20	740.2	718.2	715.2		
23+10	740.3	716.8	713.8		

Top of Key: Is calculated as 3 feet above Bottom of Key.

Top of Clay: Indicates the top of a clay layer located above the clay key-in layer.

TABLE 3.1

**Visual Classification of Key-In Material
Zion Waste Management Facility**

Station	Clay Pad Elev.	Top of Key	Bottom of Key	Top of Clay	Sample No.
23+00	740.2	716.2	713.2	732.2	WH-KEY-03
22+90	739.8	718.3	715.3		
22+80	739.7	718.2	715.2		
22+70	739.8	719.3	716.3		
22+60	739.5	720.0	717.0		
22+50	739.7	719.7	716.7	731.6	WH-KEY-04
22+40	739.5	719.0	716.0		
22+30	739.6	718.6	715.6		
22+20	739.5	718.0	715.0		
22+10	739.6	717.6	714.6		
22+00	739.6	719.6	716.6		
21+90	739.6	719.6	716.6		
21+80	740.3	719.8	716.8		
21+75	740.9	719.3	716.3		
21+70	740.8	719.3	716.3		
21+60	740.8	719.3	716.3		Corner
21+50	741.0	719.0	716.0		
21+40	740.9	718.9	715.9		
21+30	741.3	719.3	716.3		
21+20	741.3	719.3	716.3		

Top of Key: Is calculated as 3 feet above Bottom of Key.

Top of Clay: Indicates the top of a clay layer located above the clay key-in layer.

TABLE 3.1

**Visual Classification of Key-In Material
Zion Waste Management Facility**

Station	Clay Pad Elev.	Top of Key	Bottom of Key	Top of Clay	Sample No.
21+10	741.7	718.7	715.7	733.3	WH-KEY-05
21+00	742.3	719.3	716.3		
20+90	742.8	718.8	715.8		
20+80	742.9	718.9	715.9		
20+70	742.6	718.6	715.6		
20+60	742.4	718.4	715.4	733.3	WH-KEY-06
20+50	742.6	718.6	715.6		
20+40	742.6	718.6	715.6		
20+30	742.6	717.1	714.1		
20+20	742.4	718.4	715.4		
20+10	742.4	717.4	714.4		
20+00	742.3	716.3	713.3		
19+90	742.0	718.0	715.0		
19+80	742.0	718.0	715.0		
19+70	741.9	718.9	715.9		
19+60	741.9	719.4	716.4		
19+50	741.8	718.8	715.8		
19+40	741.7	719.7	716.7		
19+30	741.6	717.6	714.6		
19+20	741.4	716.4	713.4		

Top of Key: Is calculated as 3 feet above Bottom of Key.

Top of Clay: Indicates the top of a clay layer located above the clay key-in layer.

TABLE 3.1

**Visual Classification of Key-In Material
Zion Waste Management Facility**

Station	Clay Pad Elev.	Top of Key	Bottom of Key	Top of Clay	Sample No.
19+10	741.4	717.4	714.4		
19+00	741.6	717.6	714.6	732.6	WH-KEY-07
18+90	741.6	714.6	711.6		
18+80	741.5	714.5	711.5		
18+70	741.5	714.5	711.5		
18+60	741.3	714.3	711.3		
18+50	740.9	712.9	709.9		
18+40	740.6	711.6	708.6		
18+30	740.5	713.5	710.5		
18+20	740.3	714.3	711.3		
18+10	740.1	713.1	710.1		
18+00	740.0	715.0	712.0	732.0	WH-KEY-08
17+90	740.0	718.0	715.0		
17+80	740.0	717.5	714.5		
17+70	739.7	718.7	715.7		
17+60	739.4	718.2	715.2		
17+50	739.3	717.3	714.3		
17+40	739.3	717.3	714.3		
17+30	739.3	717.8	714.8		
17+20	739.1	716.6	713.6		

Top of Key: Is calculated as 3 feet above Bottom of Key.

Top of Clay: Indicates the top of a clay layer located above the clay key-in layer.

TABLE 3.1

**Visual Classification of Key-In Material
Zion Waste Management Facility**

Station	Clay Pad Elev.	Top of Key	Bottom of Key	Top of Clay	Sample No.
17+10	739.1	716.6	715.9		
17+00	738.9	718.9	715.9	730.9	WH-KEY-09
16+90	738.9	718.4	715.4		
16+80	738.9	718.4	715.4		
16+70	738.7	718.7	715.7		
16+60	738.5	719.0	716.0		
16+50	738.3	717.8	714.8		
16+40	738.0	719.0	716.0		
16+30	737.7	716.7	713.7		
16+20	737.5	716.0	713.0		
16+10	737.1	719.1	716.1		
16+00	737.3	719.0	716.0	728.8	WH-KEY-10
15+90	737.3	718.8	715.8		
15+80	737.3	717.3	714.3		
15+70	737.2	718.2	715.2		
15+60	737.1	717.6	714.6		
15+50	737.0	717.5	714.5		
15+40	737.0	717.5	714.5		
15+30	736.8	717.3	714.3		
15+20	736.7	717.7	714.7		

Top of Key: Is calculated as 3 feet above Bottom of Key.

Top of Clay: Indicates the top of a clay layer located above the clay key-in layer.

TABLE 3.1

**Visual Classification of Key-In Material
Zion Waste Management Facility**

Station	Clay Pad Elev.	Top of Key	Bottom of Key	Top of Clay	Sample No.
15+10	736.5	717.5	713.5		
15+00	736.3	718.3	715.3	730.0	WH-KEY-11
14+90	736.1	719.6	716.6		
14+80	735.9	717.9	714.9		
14+70	735.8	718.8	715.8		
14+60	735.6	717.1	714.1		
14+50	735.4	716.4	713.4		
14+40	735.4	719.4	716.4		
14+30	735.3	718.3	715.3		
14+20	735.3	718.3	715.3		
14+10	735.3	718.8	715.8		
14+00	735.4	718.4	715.4	730.4	WH-KEY-12
13+90	736.2	719.7	716.7		
13+80	737.2	719.2	716.2		
13+70	737.6	718.6	715.6		
13+60	738.4	718.4	715.4		
13+50	738.9	716.9	713.9		
13+40	739.5	714.0	711.0		
13+30	740.1	714.6	711.6		
13+25	741.0	715.0	712.0	729.0	Refuse at elev. 733.0 - 729.0.

Top of Key: Is calculated as 3 feet above Bottom of Key.

Top of Clay: Indicates the top of a clay layer located above the clay key-in layer.

TABLE No. 3.2

**Quality Assurance Tests on Bentonite-Water Slurry
Zion Waste Management Facility**

Test	Location	Frequency	Remarks
Density	Mixer	3 times/day	Determine density when ever additional slurry is added.
Density	Pipe	3 times/day	
Density	Trench	3 times/day	
Viscosity	Mixer	3 times/day	Determine viscosity when ever additional slurry is added.
Viscosity	Pipe	3 times/day	
Viscosity	Trench	3 times/day	
Filter Press	Trench	3 times/day	

Table No. 3.3

**Quality Assurance Tests in Field on Bentonite-Water Slurry
Zion Waste Management Facility**

Test Number	Date	Location	Station	Viscosity (sec.)	Density (lbs./ft ³)	Filtrate (ml)	Temp. (F)	Time of Sample
1	11-10-90	Pipe	25+05	46.0	64.0		50	10:00
2	11-10-90	Pipe	25+05	50.0	67.0		54	12:50
3	11-10-90	Mixer		58.0	67.0		54	11:30
4	11-10-90	Mixer		41.0	64.5		44	3:40
5	11-10-90	Trench						
6	11-10-90	Trench						
7	11-11-90	Pipe	24+70	43.0	67.0		37	9:30
8	11-11-90	Pipe	24+70	46.0	68.0		39	12:30
9	11-11-90	Mixer		42.0	64.0		40	11:00
10	11-11-90	Mixer		45.0	65.0		44	1:00
11	11-11-90	Trench	24+50	51.0	68.5		41	10:10
12	11-11-90	Trench	24+50	50.0	67.0		46	12:30
13	11-12-90	Mixer		42.0	65.0		40	9:45
14	11-12-90	Mixer		48.0	67.0		45	11:50
15	11-12-90	Trench	24+00	46.0	68.5	14.5	40	10:00
16	11-12-90	Trench	23+50	52.0	71.0	14.0	43	11:00
17	11-12-90	Pipe	24+80	45.0	68.0		38	9:15
18	11-12-90	Pipe	24+00	43.0	67.0		43	11:30
19	11-13-90	Mixer		42.0	65.0		40	7:15
20	11-13-90	Mixer		41.0	64.5		43	9:45
21	11-13-90	Mixer		43.0	64.0		45	11:20
22	11-13-90	Mixer		44.0	64.5		46	2:30
23	11-13-90	Pipe	23+80	41.0	63.0		41	8:35
24	11-13-90	Pipe	21+50	42.0	66.5		48	10:38
25	11-13-90	Pipe	21+50	42.0	67.5		46	11:15

Table No. 3.3

Quality Assurance Tests in Field on Bentonite-Water Slurry
Zion Waste Management Facility

Test Number	Date	Location	Station	Viscosity (sec.)	Density (lbs./ft3)	Filtrate (ml)	Temp. (F)	Time of Sample
26	11-13-90	Trench	22+00	46.0	67.0	14.5	43	9:00
27	11-13-90	Trench	21+00	44.0	68.5	15.0	50	12:30
28	11-13-90	Trench	20+00	43.0	72.0	15.0	54	3:00
29	11-14-90	Mixer		42.0	66.5		41	11:00
30	11-14-90	Mixer		41.0	63.5		50	1:15
31	11-14-90	Mixer		40.0	66.0		52	2:15
32	11-14-90	Pipe	19+80	44.0	68.0		42	9:13
33	11-14-90	Pipe	19+80	41.0	63.5		45	12:40
34	11-14-90	Pipe	19+80	44.0	66.5		49	1:30
35	11-14-90	Trench	20+00	43.0	67.0	15.0	44	10:30
36	11-14-90	Trench	19+00	43.0	71.0	15.0	53	11:45
37	11-14-90	Trench	18+00	46.0	67.5	15.0	63	1:00
38	11-15-90	Mixer		42.0	64.5		43	7:15
39	11-15-90	Mixer		43.0	65.5		53	9:15
40	11-15-90	Mixer		43.0	66.0		58	2:00
41	11-16-90	Mixer		43.0	65.5		45	8:45
42	11-16-90	Mixer		40.0	64.5		50	12:30
43	11-16-90	Mixer		42.0	65.5		50	2:00
44	11-17-90	Mixer		43.0	66.0		47	10:15
45	11-17-90	Mixer		41.0	65.0		42	8:00

R 001426

TABLE No. 3.4

Quality Assurance In-Field Testing of Trench Backfill
Zion Waste Management Facility

Date	Location	Slump (in.)	Density (lbs./ft3)	Temp. (F)	<#200 (percent)	Station Daylight	Station Toe	Sample No.
11-10-90	25+00	4.0	114.0	50	71.9			
11-11-90	25+00	4.0	110.0	44	53.1			WH-BF-01
11-11-90						25+25	24+70	
11-12-90	24+00	5.0	122.0	48	50.0			WH-BF-02
11-12-90						24+70	23+30	
11-13-90	23+00	6.0	114.5	51	46.9			WH-BF-03
11-13-90						22+40	21+10	
11-13-90						21+75	20+30	
11-13-90	22+00							WH-BF-04
11-14-90	21+00	5.5	121.5	57	46.1			WH-BF-05
11-14-90	20+00	5.0	123.0	58				WH-BF-06
11-14-90						21+00	19+00	
11-14-90						20+00	17+40	

TABLE No. 3.4

**Quality Assurance In-Field Testing of Trench Backfill
Zion Waste Management Facility**

Date	Location	Slump (in.)	Density (lbs./ft3)	Temp. (F)	<#200 (percent)	Station Daylight	Station Toe	Sample No.
11-15-90	19+00	5.5	121.5	53	47.4			WH-BF-07
11-15-90						19+50	16+30	
11-15-90						17+75	15+40	
11-16-90	18+00	4.0	117.0	43				WH-BF-08
11-16-90	17+00	6.0	120.5	43				WH-BF-09
11-16-90	16+00	6.0	123.3	48				WH-BF-10
11-17-90	15+00	6.0	120.0	50				WH-BF-11

Table 3.5

Laboratory Test Results
for
Key-In Material
Zion Waste Management Facility

Date	Station	Sample No.	Elevation	LL	PL	PI	P-200	Classification
11-10-90	25+00	WH-KEY-01	716.3					LEAN CLAY (CL) dark gray, w/little sand and gravel.
11-11-90	24+00	WH-KEY-02	715.0					LEAN CLAY (CL) dark gray, w/little sand and gravel.
11-11-90	23+00	WH-KEY-03	713.2	28.3	14.5	13.8	84.6	LEAN CLAY (CL) dark gray, w/little sand and gravel.
11-13-90	22+00	WH-KEY-04	716.6					LEAN CLAY (CL) dark gray, w/little sand and gravel.
11-13-90	21+00	WH-KEY-05	716.3	28.1	14.3	13.8	84.1	LEAN CLAY (CL) dark gray, w/little sand and gravel.
11-13-90	20+00	WH-KEY-06	713.3					LEAN CLAY (CL/CL-ML) dark gray w/ trace of sand.

R 001429

Table 3.5
Laboratory Test Results
for
Key-In Material
Zion Waste Management Facility

Date	Station	Sample No.	Elevation	LL	PL	PI	P-200	Classification
11-14-90	19+00	WH-KEY-07	714.6					LEAN CLAY (CL/CL-ML) dark gray w/ trace of sand.
11-14-90	18+35	WH-KEY-7A	709.5	22.9	12.8	10.1	76.0	LEAN CLAY (CL/CL-ML) dark gray w/ trace of sand.
11-14-90	18+00	WH-KEY-08	712.0	23.4	13.8	9.6	76.6	LEAN CLAY (CL/CL-ML) dark gray w/ trace of sand.
11-14-90	17+00	WH-KEY-09	715.9					LEAN CLAY (CL/CL-ML) dark gray w/ trace of sand.
11-15-90	16+00	WH-KEY-10	716.0					LEAN CLAY (CL/CL-ML) dark gray w/ trace of sand.
11-15-90	15+00	WH-KEY-11	715.3	22.1	12.9	9.2	75.9	LEAN CLAY (CL/CL-ML) dark gray w/ trace of sand.
11-16-90	14+00	WH-KEY-12	715.4	26.0	14.1	11.9	81.6	LEAN CLAY (CL) dark gray, w/ trace sand and gravel.

TABLE 3.6

**Summary of Laboratory Soil Testing
for
Backfill Material
Zion Waste Management Facility**

Date	Sample No.	Station	P-200	LL	PL	PI	CLAY Content
11-10-90	WH-BF-01	25+00	80.2	34.4	15.3	19.1	44.5
11-12-90	WH-BF-02	24+00	79.1	31.4	14.6	16.8	42.5
11-13-90	WH-BF-03	23+00	76.7	31.6	15.0	16.6	39.5
11-13-90	WH-BF-04	22+00	73.8	30.9	15.1	15.8	38.5
11-14-90	WH-BF-05	21+00	77.3	34.8	15.3	19.5	41.5
11-14-90	WH-BF-06	20+00	74.2	32.6	14.8	17.8	38.5
11-15-90	WH-BF-07	19+00	75.2	33.9	15.0	18.9	39.0
11-16-90	WH-BF-08	18+00	75.3	32.7	15.6	17.1	38.5
11-16-90	WH-BF-09	17+00	74.3	34.2	14.7	19.5	40.0
11-16-90	WH-BF-10	16+00	75.6	34.4	16.4	18.0	40.5
11-17-90	WH-BF-11	15+00	72.2	44.6	15.1	29.5	39.5

Table 3.7

**Summary of Laboratory Soil Permeability
for
Backfill Material
Zion Waste Management Facility**

DATE	SAMPLE No.	STATION	MOISTURE CONTENT	DRY DENSITY	PERMEABILITY (cm/sec)
11-13-90	WH-BF-03	23+00	26.4	102.7	1.9×10^{-8}
11-14-90	WH-BF-05	21+00	30.4	92.9	2.2×10^{-8}
11-16-90	WH-BF-09	17+00	29.7	92.2	3.1×10^{-8}

Appendix A

Design Mix by Ground Improvement Techniques (GIT)



ground improvement techniques, inc.

P.O. BOX 17340
300 PENN CENTER BLVD.
SUITE 308
PITTSBURGH, PA 15235
412-825-0400
1-800-448-1500
FAX # 412-825-0404

SOUTHEAST OFFICE
3285 BOGGY CREEK ROAD
KISSIMMEE, FL 34744
407-348-1334
1-800-873-4484
FAX # 407-348-1335

WESTERN OFFICE
P.O. BOX 56
WOODLAND, WA 98674
206-225-6588
FAX # 206-225-8007

November 1, 1990

Mr. Timothy J. Ambrosius
McDonald-Maas Associates
1410 Main Street
Suite 201
P.O. Box 11507
Green Bay, WI 54307-1507

RE: BFI
Zion, IL
Mix Design - Slurry Trench Cut-Off Wall

Tim:

Per our preconstruction meeting of October 9, 1990 for the referenced project, we have attached the mix design and certification for the bentonite. We will be on site Monday, November 6, 1990 and have bentonite scheduled for delivery Tuesday.

Sincerely,

A handwritten signature in dark ink, appearing to read "Thomas H. Kaniecki", is written over a horizontal line.

Thomas H. Kaniecki
Regional Manager

THK/jaw

Enclosure

GROUND IMPROVEMENT TECHNIQUES, INC.
SLURRY WALL - ZION ILLINOIS
DESIGN & PROCEDURES

GENERAL

GIT will construct a soil bentonite slurry wall at the BFI Zion, Illinois site from station 13+86 to station 25+05. William Coneybeer will be the Project Superintendent and Slurry Specialist for the project. He will be on site during the duration of the project. Thomas Kaniecki will be the Project Manager for the project and can be contacted at the Pittsburgh GIT office. GIT will be constructing a three (3) foot wide cut-off wall to the design depth with a final permeability of 1×10^{-7} cm/sec. It is GIT's intent to start excavation at station 25+05 proceeding toward station 13+86 and tie in to the existing trench at that point.

BENTONITE - WATER SLURRY

GIT will provide and operate all equipment and supply materials necessary for mixing, handling, pumping, and recirculating the bentonite slurry.

Bentonite used in preparing the slurry will be supplied by Federal Bentonite. The bentonite will be a pulverized high-swelling natural Wyoming sodium bentonite, meeting API specification 13A, "Oil-Well Drilling Fluid Materials". The bentonite prior to use will be adequately protected from moisture and contaminants.

Water used for the mixing of the bentonite-water slurry will be from the on-site holding pond near the trench. GIT will use a circulating supply system to avoid waste.

The stabilizing bentonite-water slurry will be mixed in a six (6) cubic yard colloidal mixer. The high shear action at the mixer will assure complete dispersion of the bentonite particles in the water. Mixing will continue until full hydration of the bentonite is accomplished prior to introduction into the trench. Bentonite content in the slurry will range between 4% and 6% depending primarily on the quality of the mixing water.

Slurry introduced into the trench will have a minimum viscosity of forty (40) seconds, as measured with a standard marsh funnel.

The bentonite-water slurry will have a filtrate loss of no more than 20cm³ during the performance of a standard filter press test in accordance with API specification 13B (100 psi pressure for a 30 minute duration).

The density of the bentonite-water slurry prior to introduction into the trench will be no less than 63.5 pcf.

EXCAVATION

The trench will be excavated vertically from the working surface through site fill materials and natural overburden soils and key a minimum of three (3) feet into underlying natural impervious strata, but the bottom of the cut-off wall will be a maximum elevation of 720 feet above mean sea level. The cut-off wall will be excavated in a continuous fashion with a 245 caterpillar backhoe.

The cut-off wall will be constructed to the elevations, lines, grades, and cross section as shown on the Final Design Drawings unless otherwise directed by the Company/Engineer. The cut-off wall will be a minimum of three (3) feet wide. The vertical alignment of the cut-off wall will not deviate more than three (3) percent of the full wall depth in any direction transverse to the horizontal wall alignment. Any deviation greater than this limit for the proposed alignment will require approval of the Engineer.

The cut-off wall will extend from the working surface through the site fill materials, natural overburden soils, and spatially variant sands occurring around Elev. 720. The cut-off wall will key a minimum of three (3) feet into underlying natural impervious strata. GIT will inform the Resident Geotechnical Engineer when the trench excavation reaches the bottom limit so that the Resident Geotechnical Engineer will be the judge as to the necessity for extending the trench below the elevations as shown on the Drawings. Bentonite-water slurry will be introduced into the trench at the beginning of the excavation, before a depth of six (6) feet is reached, and will be maintained at a level not more than two (2) feet below the top of the trench throughout the trenching operations. Unsuitable materials excavated will be disposed of by BFI. Excavated material will be examined by the Geotechnical Engineer to assure suitability for backfill.

BACKFILL

The impervious backfill placed into the trench after excavation will consist of a mixture of select excavated soils and/or borrow materials from an approved borrow area and bentonite-water slurry. The excavated soils will be mixed and blended with new or recycled bentonite-water slurry. Blending will continue until the soil-bentonite backfill is homogenous and does not contain unmixed pockets of slurry or soil lumps.

Backfill will be placed so that no pockets of slurry are present in the completed cut-off wall. Placement operations shall proceed in a fashion such that the surface of the trench will follow a reasonably smooth grade and will not have hollows which may trap pockets of slurry during subsequent backfilling.

Placement of backfill will not be made until the trench or a portion thereof has been inspected, approved and measured by the Resident Geotechnical Engineer.

The initial backfill will be placed with a dozer in a lead-in trench with slope no greater than 1-v on 2-h to a point of design depth.

After initial backfill has been placed so that its surface rises above the slurry level, additional backfill will be placed at the top of the previously deposited backfill so that the backfill below the slurry surface will slowly slide forward down the backfill slope, displacing the slurry as it progresses.

Backfilling operations will be carried out so that the toe of the backfill is not less than 25 feet or more than 100 feet from the toe of the excavation to permit inspection and measurement.

The backfill material, just prior to placement will have a consistency of wet concrete with a slump of four (4) to six (6) inches as determined by ASTM C143-78.

No frozen backfill will be placed in the slurry trench.

Select materials supplied by BFI for use in the backfill will have a minimum fines content of 20 percent and will be free of deleterious materials including topsoil, organics, trash, and debris.

The backfill will have a minimum bentonite content of one percent by dry weight of soil.

The mixed and blended backfill will have sufficient plasticity to allow rolling to a 1/8-inch thread in accordance with procedures outlined in ASTM D 424-59.

Appendix B

Qauality Assurance Manual

for the

Slurry Trench Cutoff Wall

**QUALITY ASSURANCE MANUAL
FOR THE
CONSTRUCTION OF THE SLURRY TRENCH
CUTOFF WALL**

**ZION WASTE MANAGEMENT FACILITY
ZION, ILLINOIS**

OCTOBER 1990

Prepared for:

**BROWNING-FERRIS INDUSTRIES OF
ILLINOIS, INC.**

**ZION WASTE MANAGEMENT FACILITY
42575 North Greenbay Road
Zion, Illinois 60099**

Prepared by:

MC DONALD - MAAS ASSOCIATES

**1410 Main Street - Suite 201
P.O.Box 11507
Green Bay, Wisconsin 54307-1507**

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APPENDIX "A"

Daily Report Form

1.0 INTRODUCTION

1.1 Terms of Reference

1.1.1 Purpose

This manual is intended for the use of the on-site quality assurance person for the continuation construction of the slurry trench cutoff wall at the Zion Waste Management Facility, Zion, Illinois.

The site specific construction specifications were provided by Browning-Ferris Industries (BFI) under SECTION VII - PROJECT REQUIREMENTS of the Contract Documents titled DESIGN AND CONSTRUCTION OF SLURRY TRENCH CUTOFF WALL, ZION WASTE MANAGEMENT FACILITY, ZION, ILLINOIS.

The slurry trench cutoff wall alignment is planned to cutoff the south and southeast sections of the codisposal unit. This manual is devoted to the quality assurance and quality control for the construction of the slurry trench cutoff wall.

Quality Assurance refers to the means and actions employed by the Resident Geotechnical Engineer to assure the construction conforms with the project requirements and specifications. This service is provided by a third party independent from both production and installation.

Quality Control refers to the actions taken by the manufacturer and contractor to ensure that the materials and workmanship of the above project meet the intent of the plans and specifications. Quality control is provided by the manufacturer and contractor.

1.1.2 Definitions

Company:

Browning-Ferris Industries of Illinois, Inc.
1827 Walden Office Square Suite 107
Schaumburg, Illinois 60173

Engineer:

Mr. Michael W. Williams, BFI
1827 Walden Office Square Suite 107
Schaumburg, Illinois 60173
Telephone: (708) 397-7760.

Resident Geotechnical:

The on-site technical representative is responsible for quality assurance and testing in accordance with the

project requirements and specifications. These responsibilities include observing, evaluating, and documenting geotechnical conditions during the construction progress.

Mr. Timothy Ambrosius
MC DONALD - MAAS ASSOCIATES
1410 Main St. Suite 201
P.O. Box 11507
Green Bay, WI 54307-1507

Contractor:

The organization which is furnishing the materials, equipment, design, and construction of the slurry trench cutoff wall.

Ground Improvement Techniques, Inc.
Corporate Headquarters
300 Penn Center Blvd. Suite 308
P.O. Box 17340
Pittsburgh, PA 15235

Cutoff Wall Superintendent:

Contractor's employee or representative who will act as on-site representative of the contractor during the duration of the project. This person shall be knowledgeable in all aspects of this type of construction, and shall also have the ability to bind the contractor to any construction decision.

Mr. Bill Coneybeer, G.I.T., Inc.

Soil Bentonite Slurry Trench Cutoff:

A soil bentonite slurry trench cutoff wall is a three (3) foot minimum width trench excavated in the existing overburden or fill material by the slurry method of excavation and backfilled with a specified material to form a barrier with a permeability equal to or less than 1.0×10^{-7} cm/sec.

Slurry Method of Excavation:

The slurry method of excavation consists of excavating a vertical wall trench through the overburden while at the same time keeping the trench filled with bentonite-water slurry. The basic purpose of the bentonite-water slurry is to give support to the trench walls until the backfilling procedure occurs.

Slurry:

The slurry is a stable colloidal thixotropic suspension of powdered bentonite in water.

Bentonite:

Bentonite is a natural clay whose principal material constituent is sodium montmorillonite. It shall be a pulverized, premium grade natural sodium Wyoming bentonite and shall meet API Specification 13A.

Surface Water:

Surface water is used to denote all waters that enter the working area. This water can be produced from either natural or artificial sources.

Groundwater:

Groundwater denotes all water below the existing ground surface within the working area.

Trench Water:

Trench water refers to the water used to mix the powdered bentonite to form the bentonite-water slurry. The water shall have a neutral ph.

Working Surface:

The working surface is the surface on which the equipment shall operate to construct the slurry trench cutoff wall. The slope of this surface shall be such that it does not cause slurry in the open trench to be more than two (2) feet below the top of the trench at any one location for any period of time.

Backfill:

Backfill is the blended mixture of dry bentonite, trench slurry and select backfill materials which are either excavated from the trench or supplied from a designated borrow site.

Select Materials:

Select materials are any materials which can be excavated from the excavation trench or supplied from a nearby borrow site and which are suitable for use as a component of the backfill material.

Capping:

Capping is a protective layer of soil installed over the top of the completed slurry trench cutoff wall. The purpose of the cap is to prevent desiccation erosion, and to provide an adequate foundation for construction equipment traffic.

Cleanup:

Cleanup refers to the activities of the contractor upon completion of the slurry trench cutoff wall. This refers to the removal and disposal of the water trench slurry, equipment removal, and general site aesthetics.

2.0 DOCUMENTATION

2.1 Introduction

This section is divided into several subsections which describe various items which are required for completing the construction observation of the slurry trench cutoff wall.

2.2 Surveying

The Company (BFI) will provide the benchmark elevations in order to set both line and grade for the slurry trench cutoff wall. The offset line will be 20 feet from the centerline of the slurry trench cutoff wall. The construction working pad will be constructed prior to any type of excavation. The pad will have a station and an elevation placed every ten (10) feet along the centerline. The elevation of the top of the construction pad will be recorded in the quality assurance person's field book.

2.3 Trench Excavation

2.3.1 Requirements

- a. The slurry trench cutoff wall shall be a minimum of three feet in width.
- b. The trench shall be excavated vertically from the working pad surface through the overburden materials and keyed into the predetermined low permeable soil strata.
- c. The slurry wall shall be keyed a minimum of three feet into the predetermined low permeable soil strata below the overburden soils at the site. The bottom of the slurry trench cutoff wall shall be at a maximum elevation of 717 feet above mean sea level.
- d. The cutoff wall shall be excavated in a continuous fashion using either a backhoe or other similar equipment capable of reaching the required depth.
- e. The vertical alignment of the cutoff wall shall not deviate more than three (3) percent from plumb for the full depth of the wall.
- f. Center to center horizontal distance between all monitoring wells and the slurry trench cutoff wall will be at least ten (10) feet.
- g. Bentonite-water slurry shall be introduced into the trench at the beginning of the excavation, before the trench depth reaches six (6) feet. The bentonite-water slurry level will be maintained at an elevation which

is within two (2) feet of the top of the working pad at all times.

- h. Placement of the backfill shall be made only after the resident geotechnical engineer inspects and measures the trench depth.
- i. A trench excavation profile shall be taken every 100 feet to determine the different strata of soils encountered. This distance will be less if the material type varies from the previous profile measurement.
- j. The resident geotechnical engineer shall inspect the excavated materials being removed from the top and bottom of the key and obtain a sample for every 100 feet of trench length.
- k. The bottom of the excavation shall be measured every ten (10) feet and recorded in the resident engineer's field book. The use of a weighted cloth tape shall be used to measure from the bottom of the key to the top of the construction work pad.

2.3.2 Trench Inspections

- a. Inspect the vertical alignment of the backhoe boom as often as necessary, but always after the backhoe has been moved to a new position (maximum permissible deviation is three percent).
- b. Monitor the continuity of the trench by measuring the trench bottom every ten (10) feet with a weighted cloth tape.
- c. Measure the trench profile every 100 feet and more frequently if the material changes from the previous measurements.
- d. Visually classify the soil cuttings from the trench bottom to provide a visual assurance that the trench bottom is indeed the layer into which the wall is to be keyed. Collect a five (5) pound bag sample for storage from each 100 feet of trench.
- e. Measure the slurry trench cutoff wall width every 100 feet to ensure a minimum width of three (3) feet.
- f. Record the bottom of the key elevation every ten (10) feet and record in the resident engineer's field book.

2.4 Bentonite-Water Slurry

2.4.1 Requirements

- a. Bentonite powder shall be mixed with water in a colloidal mixer or other high energy equipment that achieves complete dispersion. The slurry should be thoroughly hydrated before introduction into the cutoff trench.
- b. Bentonite shall be a pulverized premium grade natural sodium Wyoming bentonite and shall meet API specification 13A.
- c. The water source shall be from an on-site source supplied by the company (BFI). It must be approved by the resident geotechnical engineer. Water shall have a neutral ph.
- d. Additive agents may be used only upon approval of the on-site resident geotechnical engineer.
- e. The bentonite content of the bentonite-water slurry shall be a minimum four (4) percent by weight of water.
- f. Freshly mixed, but not fully hydrated bentonite-water slurry shall have a viscosity of at least 40 seconds using the Marsh Funnel.
- g. Slurry introduced into the trench excavation must have a minimum density of not less than 63.5 pcf.
- h. The bentonite-water slurry shall not lose more than 15 cubic centimeters of fluid during the performance of the Standard Filter Press Test (pressure of 100 psi applied for 30 min. duration).

2.4.2 Frequency and Locations

- a. Daily samples shall be obtained of the bentonite-water. Sampling from the mixer, the discharge pipe and the trench shall be required daily.
- b. Bentonite-water slurry contained in the trench shall be sampled daily. The sample location will be on even 100 foot stations. The slurry will be sampled three times daily. During each sampling period, a sample will be obtained directly from the trench.

2.5 Backfill Tests

2.5.1 Requirements

- a. The backfill placed in the trench after excavation may consist of a mixture of select excavated soils, borrow materials from the approved borrow site or a combination of the two. The excavated soils shall be mixed with either new or recycled bentonite-water slurry and dry bentonite. The mixture will be blended well to obtain a homogeneous backfill.
- b. No frozen backfill shall be placed in the trench.
- c. The backfill material just prior to placement shall have a consistency of wet concrete with a slump of four (4) to six (6) inches as determined per ASTM C143-79.
- d. The minimum fines content (P-200) shall be 50.0 percent.
- e. Placement of the backfill shall be from the lead-in end of the trench and shall have a slope of 2:1 or less. Additional backfill maybe placed after the backfill rises over the bentonite-water slurry. Under no circumstances will the backfill be allowed to be placed over the side of the excavated trench.
- f. Backfilling operations shall be such that the toe of the backfill is not less than 25 feet and no more than 100 feet from the toe of the excavation.
- g. The backfill shall have a coefficient of permeability of not more than 1.0×10^{-7} cm/sec.
- h. Backfill shall have a minimum bentonite content of one percent by dry weight of soil.
- i. Select materials used as backfill shall be free of topsoil, trash, and organic materials. The minimum fines contents shall be 50 percent.
- j. The blended backfill shall be tested to ensure that its total unit weight is at least 20 pounds per cubic foot (pcf) heavier than that of the bentonite-water slurry.
- k. The backfill should be sufficiently plastic to permit rolling to 1/8-inch thread.
- l. A backfill trench profile shall be monitored daily to determine the slope of the backfilling process.

2.5.2 Frequency and Locations of Field Tests

- a. Slump Testing shall be performed at a minimum frequency of one per mixing batch or a minimum of one per day, which ever is greater.
- b. Density Testing shall be at a minimum of one per mixing batch or a minimum of one per day, which ever is greater.
- c. In-Field fines contents (P-200) shall be determined at a minimum of one per mixing batch or a minimum of one per day, which ever is greater.
- d. Eleven (11) backfill samples are required for Sieve Analysis and Atterberg Limits. A sample shall be obtained from every 100 lineal feet of trench. The on-site engineer shall be responsible for obtaining the sample (a 10 pound bag sample is required).
- e. Three (3) Shelby tubes of the completed backfill shall be obtained for permeability testing. The on-site resident geotechnical engineer will determine the locations.

2.6 Construction Photographs

The Resident geotechnical engineer shall take photographs of all phases of construction. Each photo shall be properly labeled and shall include the following information on each photograph:

- a. Project Name
- b. Photo Date
- c. Subject Identification
- d. Photo Number
- e. Direction of View
- f. Orientation

2.7 Daily Reports

The resident engineer shall complete a daily inspection report on the enclosed form which outlines all the activities for that particular day. A copy of this report shall be provided to BFI's on-site representative at the end of each day. A copy of the form to be used for the daily reports is provided in Appendix "A".

2.8 Final Report

A final report documenting record construction conditions shall be submitted upon completion of the work. This report will be prepared by the Resident Geotechnical Engineer and contain daily reports, all raw test data, and record construction drawings.

APPENDIX "A"
DAILY REPORT FORM

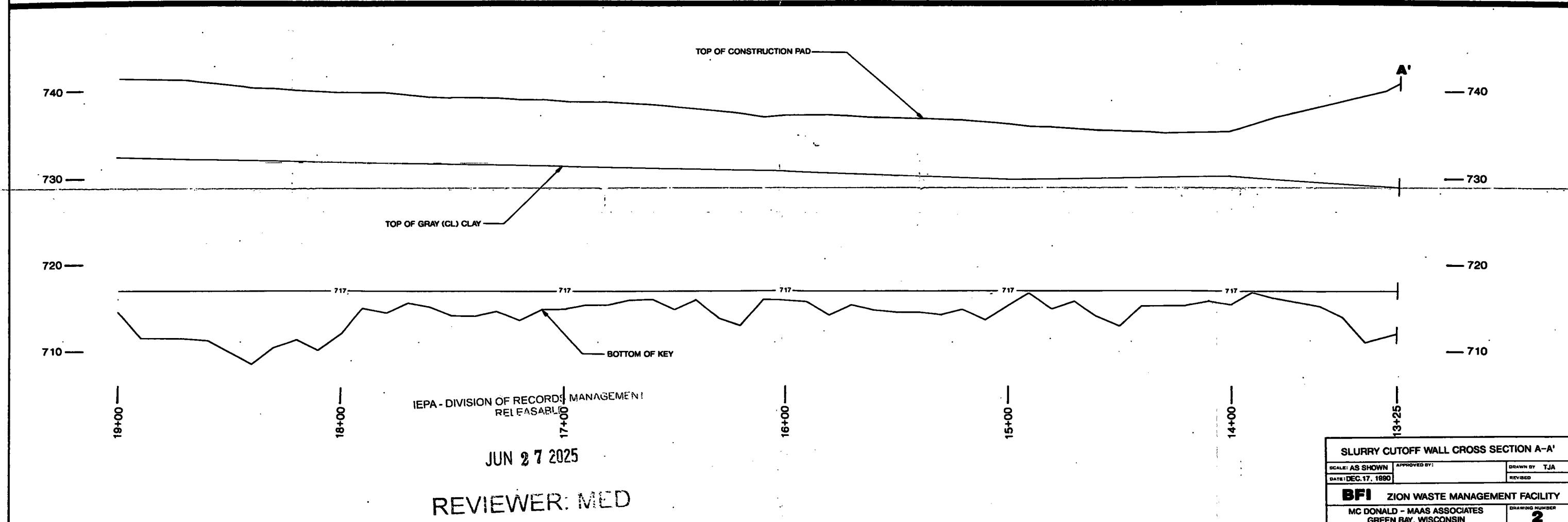
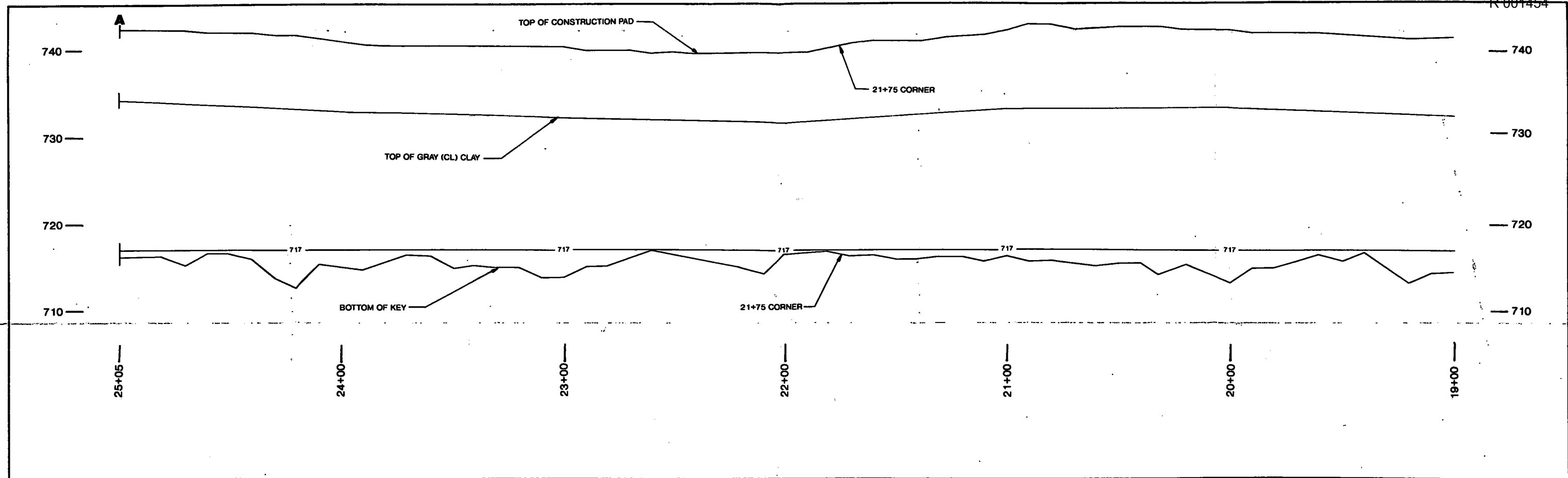
Signature:_____

Appendix C

Drawings

Drawing No. 1 - Cutoff Wall Location

Drawing No. 2 - Cutoff Wall Profile



IEPA - DIVISION OF RECORDS MANAGEMENT
REL EASABLE

JUN 27 2025

REVIEWER: MED

SLURRY CUTOFF WALL CROSS SECTION A-A'			
SCALE: AS SHOWN	APPROVED BY:	DRAWN BY: TJA	
DATE: DEC. 17, 1990		REVISED	
BFI ZION WASTE MANAGEMENT FACILITY			
MC DONALD - MAAS ASSOCIATES GREEN BAY, WISCONSIN			DRAWING NUMBER 2

Appendix D

Photo Documentation

PHOTOGRAPH LISTING

PHOTO NUMBER

PHOTOGRAPH DESCRIPTION

- 1 Mixing plant of dry bentonite with on site water. The pump in the fore ground is used to pump the mixed bentonite-water slurry to the excavated trench.
- 2 A forklift was used to haul pallets of bentonite from the stockpile to the mixer. Each pallet contained 40 bags with each bag containing 100 pounds of Wyoming bentonite.
- 3 The construction pad was constructed of compacted clay placed by BFI. The pad was constructed very close to level until station 18+00 where it had a 1% slope to the west.
- 4 The construction of the slurry trench cutoff wall was with a Cat 245 Backhoe. The backhoe was placed on top of the construction pad following centerline construction stakes.
- 5 The backhoe excavated the trench from the construction pad to a minimum elevation of 717.0 provided that the key in material was adequate.
- 6 Backhoe at station 15+00 moving west. Backhoe is sitting on the construction pad excavating to elevation 717.0.
- 7 Excavated slurry trench containing a mixture of water and 4% bentonite prior to being filled with backfill material. Photo taken at station 20+00 viewing to the west.
- 8 Slurry from the mixer is being pumped into the trench. A 4" diameter HDPE pipe is emitting a bentonite-water slurry containing 4% by weight.
- 9 Trench slurry level was kept to a minimum depth of at least 2 feet below the top of the construction pad to ensure that a cave-in would not occur. This photo is taken at station 19+00 with a view toward the west.

PHOTOGRAPH LISTING

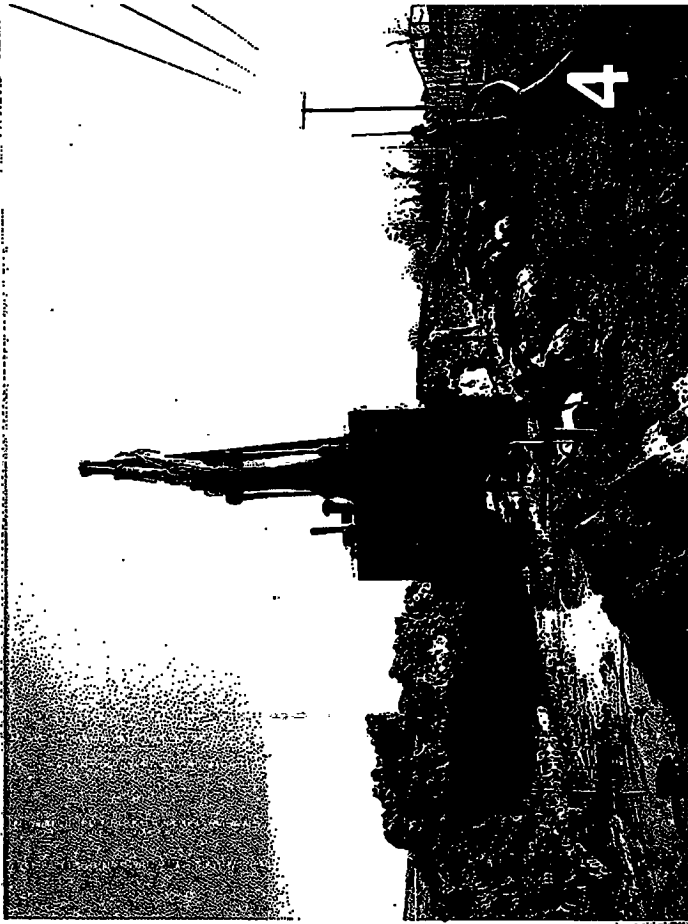
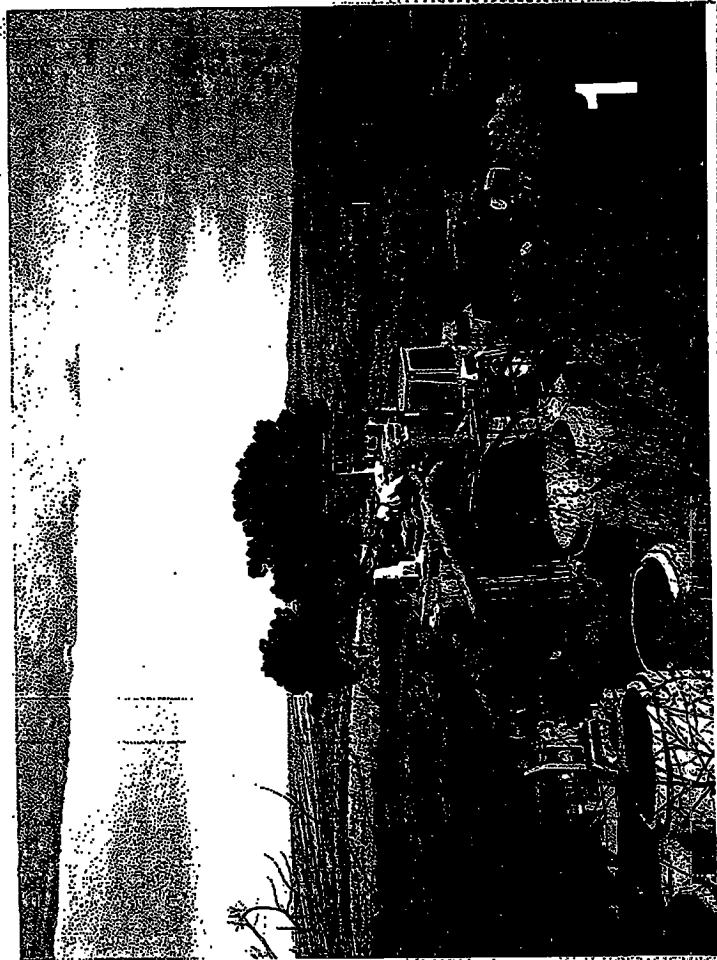
(continued)

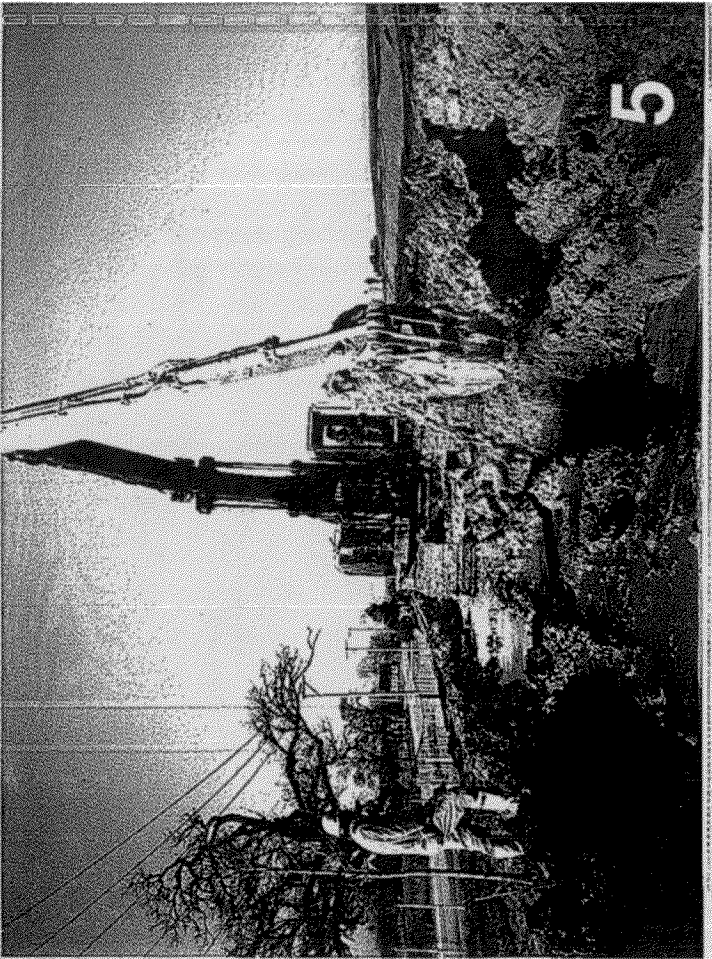
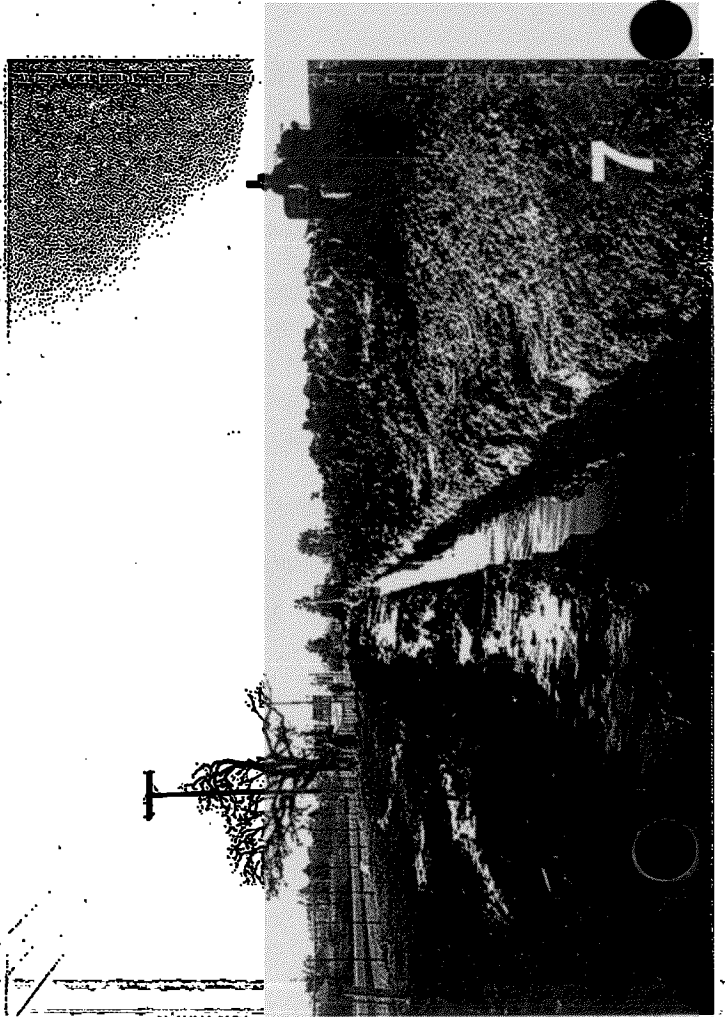
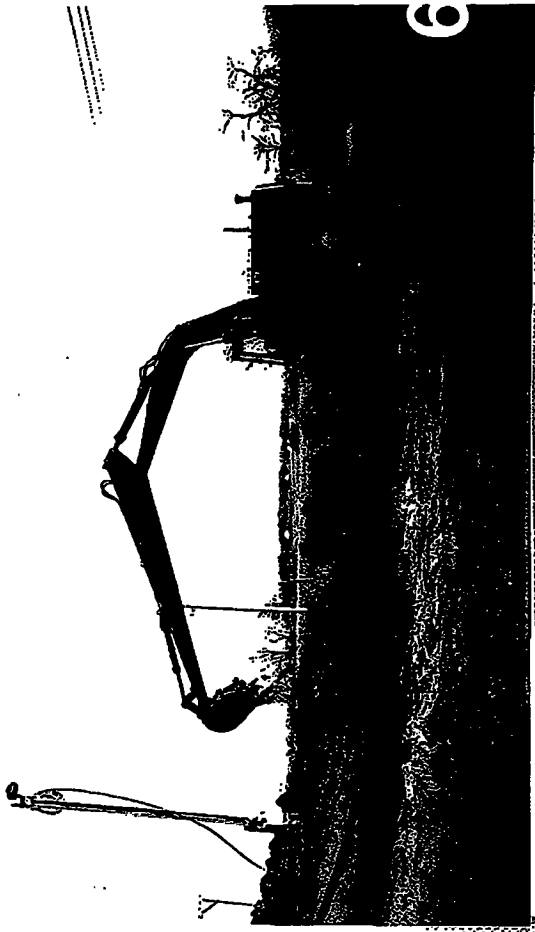
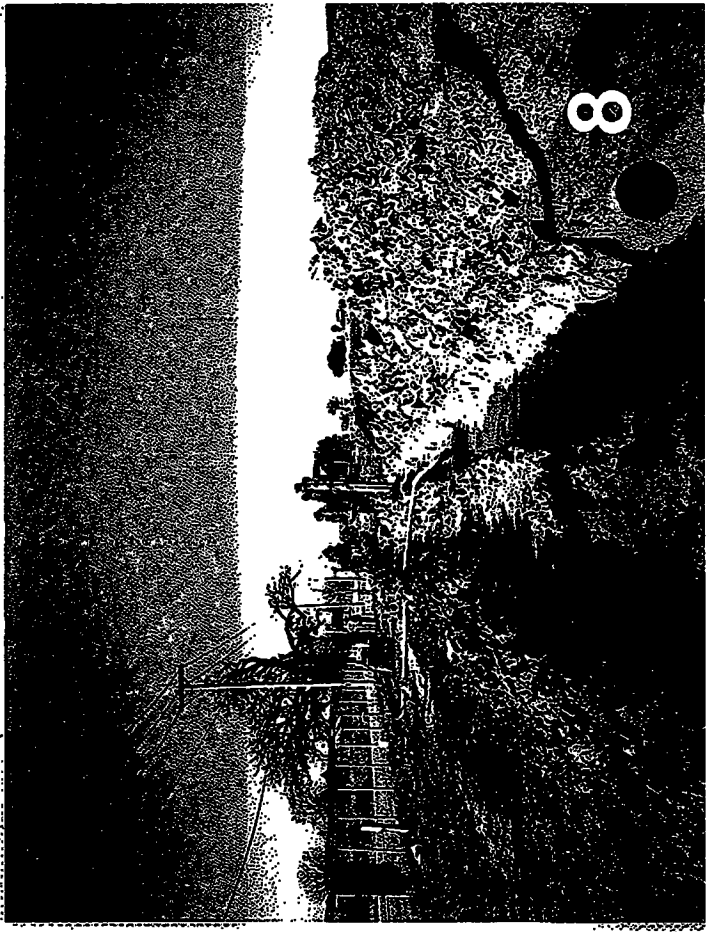
PHOTO NUMBER

PHOTOGRAPH DESCRIPTION

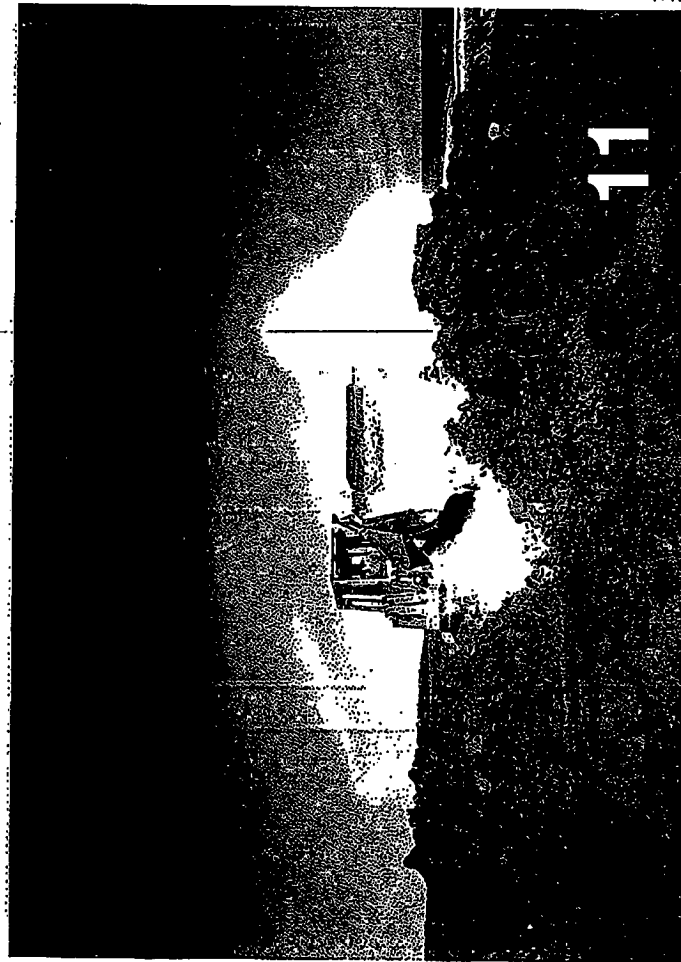
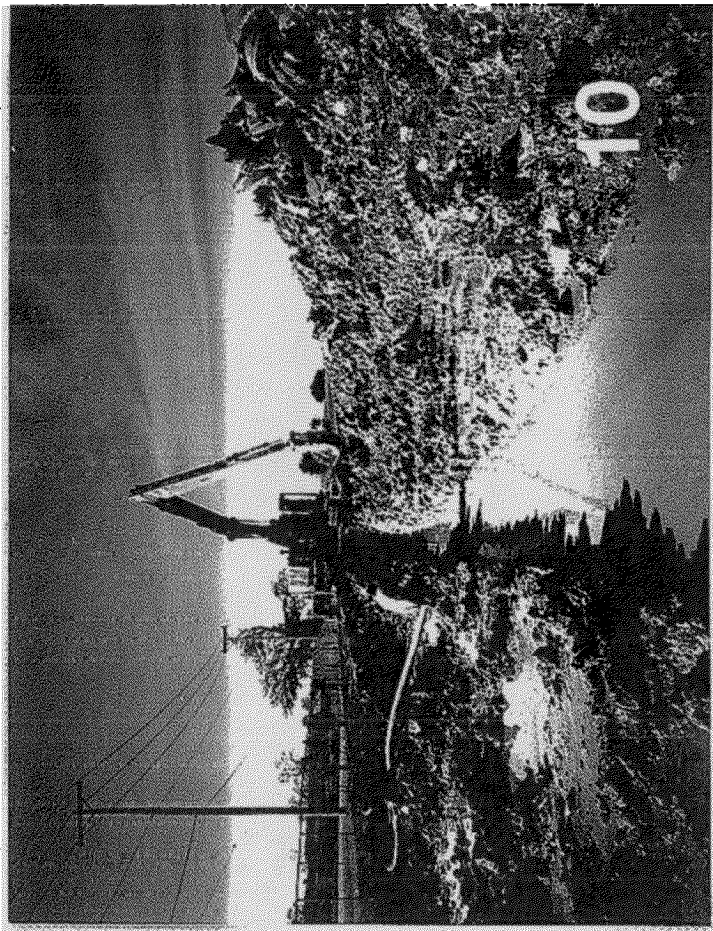
- 10 The trench slurry is tested during the day for viscosity and density. The slurry is tested at the mixer, the end of the slurry pipe, and from the trench.
- 11 Dry bentonite was added to the backfill material prior to working of the backfill. A 973 Cat Crawler was used to place the dry bentonite. The dry bentonite was placed at a rate of 1% by dry weight of soil. This computed to be 2 pallets for every 100 feet of trench.
- 12 The backfill required added moisture in order to achieve slump consistency of 4"-6". The moisture came from two sources, either the trench itself or it was freshly mixed and pumped to the backfill mixing area.
- 13 A D-5 and D-8 Caterpillar dozers were used to mix the backfill material as to achieve a consistency of wet concrete.
- 14 The backfill material was permitted to enter the trench only after complete mixing. The backfill was pushed in from the lead-in trench and was allowed to settle out.
- 15 Testing of the backfill was also conducted prior to placement into the trench. This photo shows a slump cone test being conducted.
- 16 The slurry trench had a radius of approximately 57 feet from the utility pole at the storage tank (near Gate 1). This is where the new slurry trench cutoff wall tied into the existing cutoff wall.

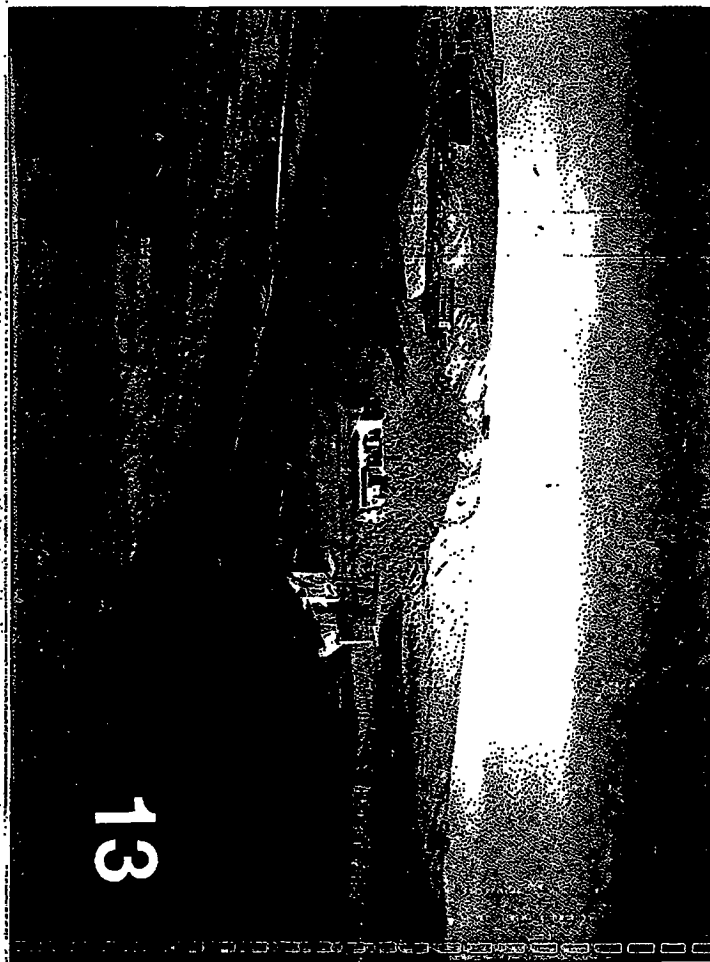
C-LINE #52581
10 OR POLAROID
PRINTS



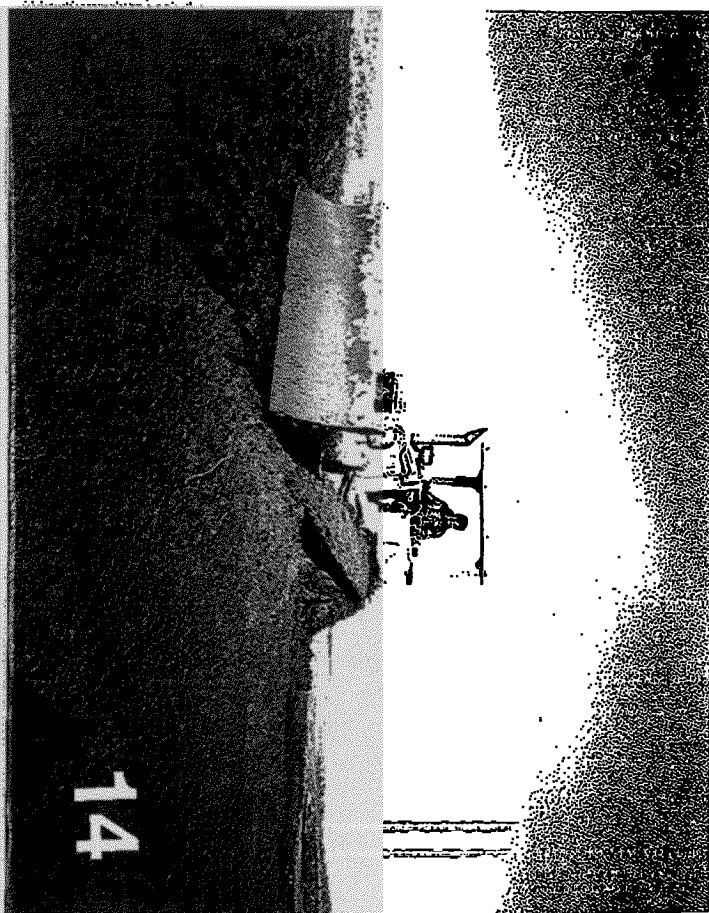


C-LINE #52581
110 OR POLAROID
PRINTS

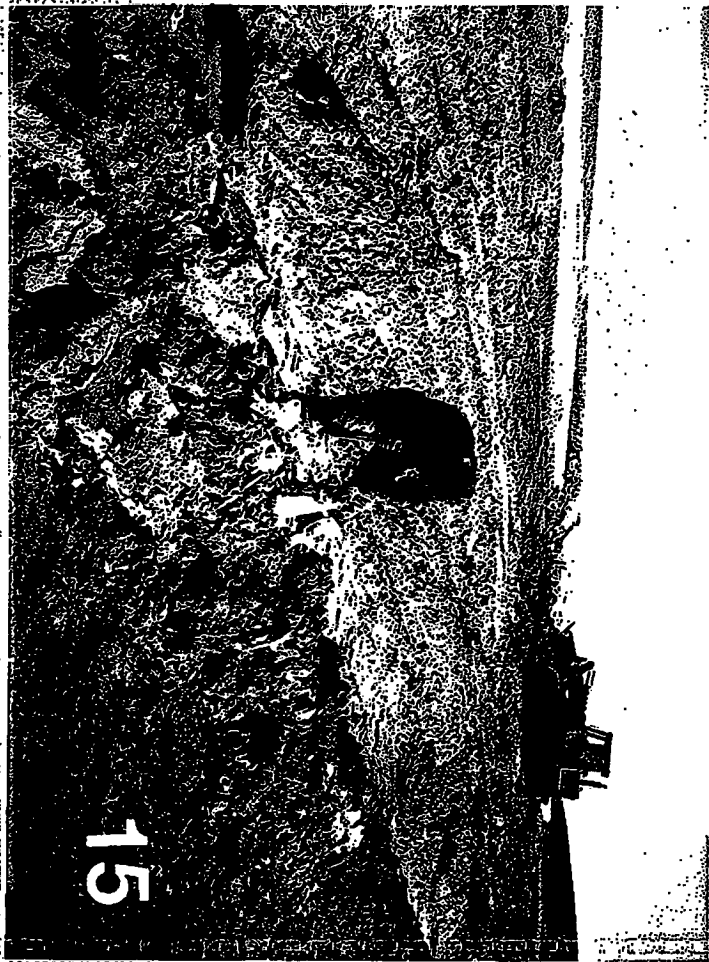




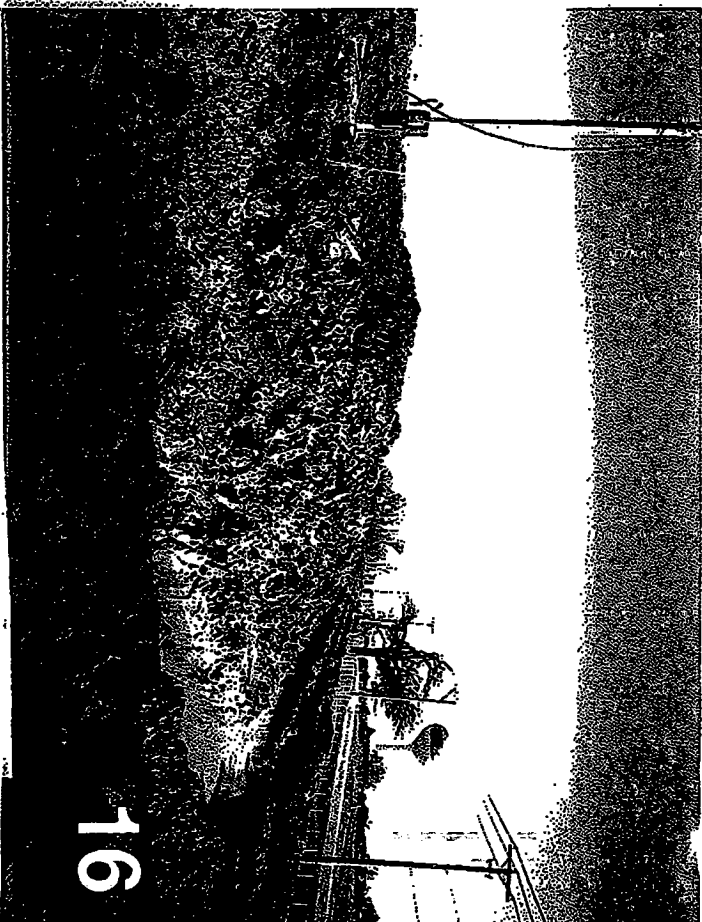
13



14



15



16

Appendix E

Resident Inspection Reports

McDonald - MaasClient Name: BROWNING - FERRIS INDUSTRIESProject Name: Slurry TRENCH CUTOFF WDate: OCTOBER 9, 1990**RESIDENT INSPECTION REPORT**Report No.: 1Project Location: WINTHROP HARBOR LANDFILL

Contract: _____

Owner: BROWNING - FERRIS INDUSTRIESWeather: RAINY / SLEET / WINDYContractor: G.T.I.Temperature: 30'SPITTSBURGH, P.A.Superintendent: BILL CONEYBEER☒ Rain☐ Snow

Foreman: _____

Field Book Reference: EB. 1 pg 1-2

Work Completed: _____

ON-SITE FOR PRECONSTRUCTION MEETING IN ATTENDANCE WERE
MIKE WILLIAMS + BILL PARENTAU OF BF
TOM KANIECKI + BILL _____ OF GTI
JOHN MAAS + MYSELF OF McDONALD-MAAS ASSOCIATES.

TOM ASKED IF A COPY OF THE PREVIOUS DESIGN BE GIVEN TO
HIM SUCH THAT GTE COULD SUBMIT THERE DESIGN AND
THAT IT WOULD HAVE THE SAME INFORMATION. (CONSTRUCTION)
IS TO START ON FAR EAST END (25+08 STATION).

SUCH THAT SLURRY PIPE CAN BE CUT OFF AS THE
MACHINE MOVES. QUESTIONING WHERE WATER WILL BE

Delays: AVAILABLE. BILL PARENTAU WILL CLARIFY A LOCATION
OR SOURCE OF WATER. ALL PARTIES WERE INFORMED ABOUT

Comments: SLURRY TESTING 4X PER DAY, BACKFILL 1-2X
PER DAY.

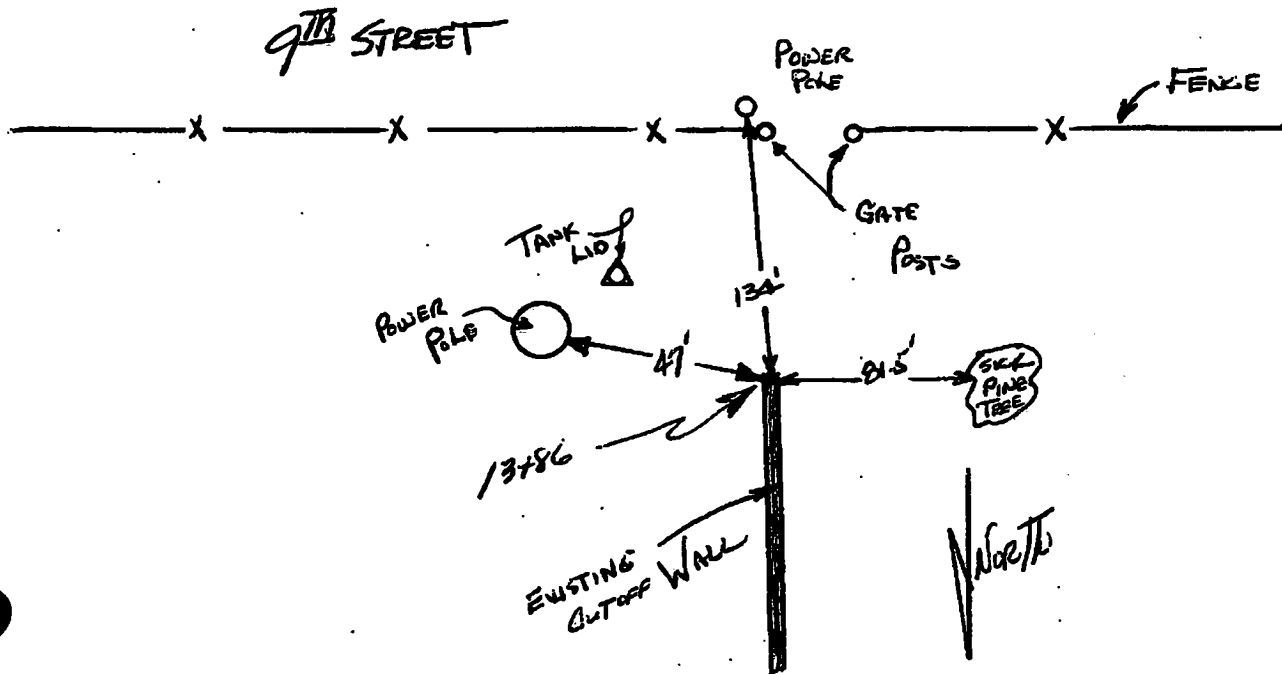
GTI PLANS TO START AS SOON AS CONTRACTS
ARE SIGNED AND THE CONSTRUCTION PAD COMPLETED.

Required Testing Performed by Inspector or Others: WE WALKED THE SITE AND
25+08 → 21+75 WAS UNDER WATER, PAD ALONG 9TH
STREET WAS LOW AND NEEDED TO HAVE MORE FILL.

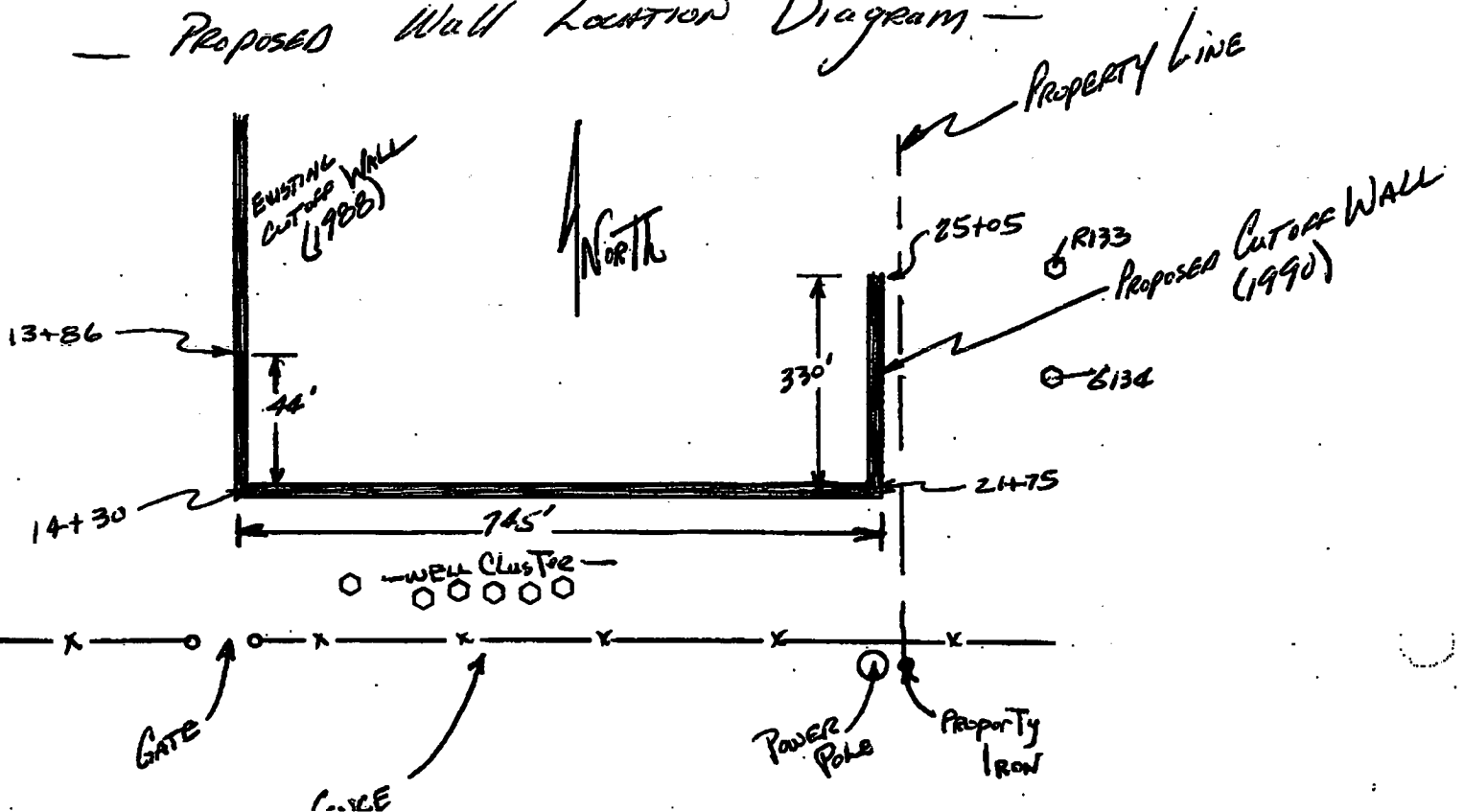
Visitors: _____

Signature: Timothy J. Phosier

TIES TO EXISTING SLURRY CUTOFF WALL 1988



Proposed Wall Location Diagram



McDonald - MassClient Name: BROWNING-FERRIS INDUSTRIESProject Name: Slurry Trench Cut-off WallDate: NOVEMBER 5, 1990**RESIDENT INSPECTION REPORT**Report No.: 2Project Location: Waltham Harbor LandfillOwner: BROWNING-FERRIS INDUSTRIES, INC.Contractor: G.I.T.
PITTSBURGH, PASuperintendent: BILL CONEYBEER

Foreman: _____

Contract: _____

Weather: RAINING - COLDTemperature: LOW 40's☒ Rain☐ SnowField Book Reference: FB 1 page 2.

Work Completed: WEATHER WAS VERY POOR. CONTRACTOR INFORMED ME THEY PLAN ON STARTING WALL CONSTRUCTION. I ARRIVED ON SITE BY 10:00AM AND MET WITH BILL PARENTEAU (BFI). HE INFORMED ME G.I.T WAS ON SITE BUT ARE HAVING TROUBLE LOCATING A CAT 245 BACKHOE MOTOR. VIEWED STARTING LOCATION OF SLURRY TRENCH WALL (STATION 25+05) THIS AREA IS UNDER WATER AND REQUIRES PUMPING. MET WITH BILL CONEYBEER FOR FIRST TIME. I ASKED WHEN HE PLANS TO BE DIGGING. WEDNESDAY LOOKS TO BE THE ACTUAL DATE. WEDNESDAY BILL SAID HE WOULD HAVE A BACKHOE LOCATED. HE FELT HE HAD PLENTY OF WORK UNTIL THEN. THE MIXER ARRIVED ON DELAY. SITE, SACKS OF BENTONITE (PALLET), MACHINE STICK FOR BACKHOE (WHEN IT DOES ARRIVE). TO REMOVE WATER MAY BE A PROBLEM PER BILL.

Comments:

PHONED: DAN DORNER - OF DORNER-STALL Construction
INQUIRING ABOUT POSSIBLE USE OF HIS
CAT 245 BACKHOE.

Required Testing Performed by Inspector or Others: RETURNED TO GREEN BAY
UNTIL WEDNESDAY (11-7-1990).

Visitors: _____

Signature: Timothy J. Ambrosino

McDonald - MaasClient Name: BROWNING-FERRIS INDUSTRIESProject Name: Slurry Trench Cutoff WallDate: NOVEMBER 7, 1990**RESIDENT INSPECTION REPORT**Report No.: 3Project Location: Winthrop Harbor Landfill

Contract: _____

Owner: BROWNING-FERRIS INDUSTRIES, LLCWeather: Sunny - CoolContractor: GITTemperature: Low 40'sPITTSBURGH, PA☐ RainSuperintendent: Bill Coneybeer☐ Snow

Foreman: _____

Field Book Reference: FB. 1 page 3

Work Completed: ARRIVED ON SITE BY 11:30 AM WITH ALL REQUIRED FIELD EQUIPMENT WHICH GIT DIDN'T HAVE. VISITED WITH Bill Coneybeer TO DETERMINE WHEN WE WILL BE ABLE TO START CONSTRUCTION. APPARENTLY A 245 CAT BACKHOE HAS BEEN LOCATED BY KENNEDY CONSTRUCTION AND SHOULD ARRIVE LATE THIS EVENING.

I BEGAN TO STAKE LOCATION OF THE SLURRY TRENCH CUTOFF WALL WITH THE OFFSET LINE 1' NORTH OF FENCE ALONG 9TH STREET. I PLACED A HUB AND LATH EVERY 100' ACCORDING TO THE PLAN SHEET. THE END OF THE EXISTING SLURRY TRENCH CUTOFF WALL WAS LOCATED.

GIT WAS WELDING HOPE - 4" ϕ PIPE TOGETHER DELAYS FOR SLURRY TO BE PUMPED FROM THE MIXER TO THE TRENCH AND ALSO FROM THE WATER SOURCE TO THE

Comments: MIXER. A TOTAL OF 4 PEOPLE FROM GIT ARE ON SITE WITH MORE EXPECTED TO ARRIVE IN AM.

Required Testing Performed by Inspector or Others: _____

Visitors: _____

Signature: Timothy J. Imbusius

McDonald - MaasClient Name: BROWNING-FERRIS INDUSTRIESProject Name: Slurry Trench Cutoff WallDate: NOVEMBER 8, 1990**RESIDENT INSPECTION REPORT**Report No.: 4Project Location: Winthrop Harbor Landfill

Contract: _____

Owner: BROWNING-FERRIS INDUSTRIES, LLCWeather: Sunny - CoolContractor: G. I. T.Temperature: Low 40'sPITTSBURGH, PA☐ RainSuperintendent: BILL CONEYBEER☐ Snow

Foreman: _____

Field Book Reference: FB 1 PAGE 4-6

Work Completed: FINISHED STAKING THE N-S WALL FROM STATION 25+05 TO 21+75 USING A 6' OFFSET TO THE EAST. PLACED A CENTERLINE HUB AND LATH AT ALL 3 CORNERS OF THE SLURRY TRENCH WALL. JERRY DREE BFI'S TECHNICAL MANAGER GAVE ME PH OF WATER SOURCE FROM THE MOST RECENT ANALYSIS PH BEING 7.8 WHICH IS STILL NEUTRAL, AND OK FOR USE IN THE WALL CONSTRUCTION. A PROPERTY LINE EXISTS WHERE THE PROPOSED SLURRY WALL IS TO BE CONSTRUCTED. I STAKED THE CENTER LINE SUCH THAT THE WALL WOULD BE 6' FROM THE PROPERTY LINE TO THE WEST. (SEE BACK FOR STAKING / WALL LOCATION). HOWARD SURVEYING FROM NICHOLSON, ILLINOIS ON SITE SETTING 100FT DOTS GRID SYSTEM. THEY HAD ALL COORDINATES PER USGS GRID SYSTEM. THEY HAD PROPERTY LINE MARKED SUCH

Comments: THAT SLURRY WALL CAN BE LOCATED.

JOHN H. (BFI) AND MYSELF SHOT THE OFFSET HUBS AND THE CENTER LINE OF THE CONSTRUCTION PAD EVERY 100'. THE PRESENT CENTER LINE OF PAD DROPS 1' FOR EVERY 100'.

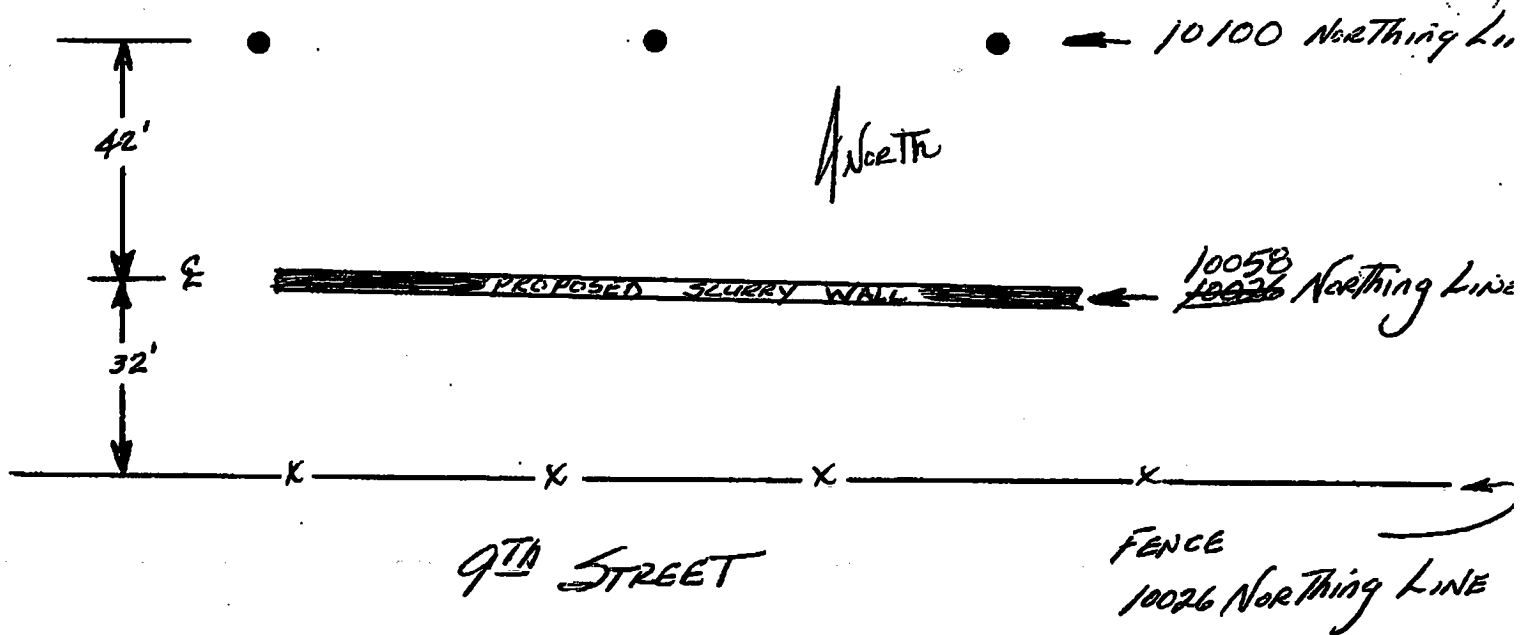
Required Testing Performed by Inspector or Others: GIT WORKED MOST OF THE PUTTING TOGETHER THE 245 CAT BACKHOE.

Visitors: HOWARD SURVEYING (CARL)

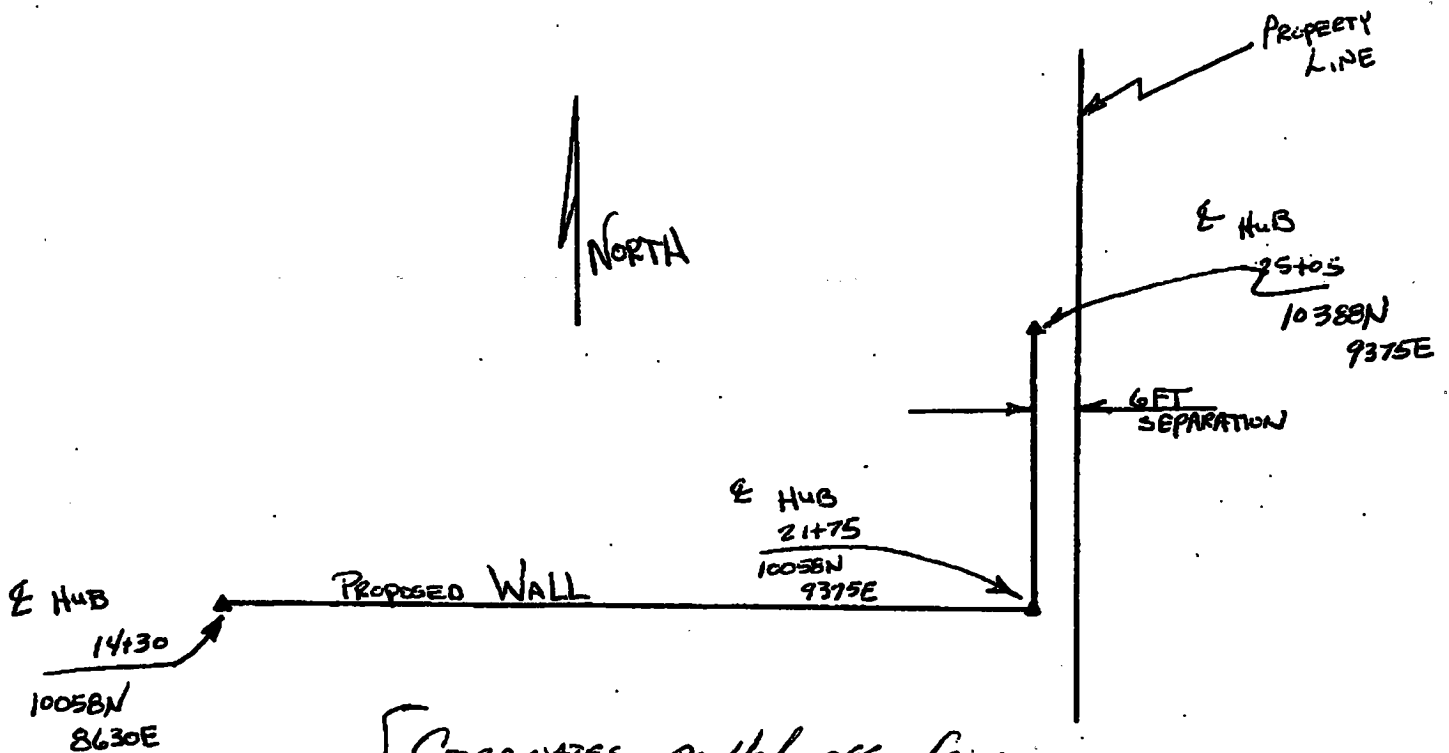
Timothy I. Phinney

— USGS GRID SYSTEM — TO THE PLAN SHEET

R 001470



— STAKED Slurry Wall IN USGS COORDINATES / PLAN SHEET. —



[COORDINATES pulled off from
HUBBED SURVEYORS GRID
LINES WHILE LAYING OUT
FINAL CONCR SURVEY]

McDonald - Maas

Client Name: Browning-Ferris Industries
 Project Name: Slurry Trench Cut-off Wall
 Date: November 9, 1990

RESIDENT INSPECTION REPORTReport No.: 5

Project Location: Winthrop Harbor Landfill
 Owner: Browning-Ferris Industries, Inc.
 Contractor: G. I. T.
Pittsburgh, PA
 Superintendent: Bill Coneybeer
 Foreman: _____

Contract: _____
 Weather: Rain-Snow-Cold
 Temperature: low 40's
☐ Rain
☒ Snow
 Field Book Reference: FB 1 pg 6-7

Work Completed: BFI MOVED A CAT 973 CRAWLER LOADER AND KOMATSU PC300LC OVER TO THE EAST SIDE OF THE PROPOSED SLURRY CUT OFF WALL. THE PAD IN THIS AREA FROM YESTERDAY SHOWED A CUT OF (2) 15 FOOT CUT TO HAVE THE PAD LEVEL FROM 24400 TO 25105 STATIONS AND ALSO A LEAD IN TRENCH AREA. THEY MOVED THE EXCESS MATERIAL EAST OF THE 40 FOOT OFFSET LINE. THIS MATERIAL CONTAINS CLAY WHICH WILL BE USED FOR EXTRA BACKFILL IF REQUIRED. THE TWO MACHINES WORK THE ENTIRE DAY.

- CALLED MIKE ABOUT THE WAY THE PROPOSAL READ HOW THE PROPOSAL STATES THAT TOP OF KEY IS 720.0 THEREFORE BOTTOM MUST BE 717.0 IN WHICH WE ARE SHOOTING FOR. AROUND DELAYS: THE WELL NEXT WE MAY BE AROUND 710.0

GIT IS MOVING SLURRY LINES, WATER LINES AND

Comments: DOING MINOR ADJUSTMENTS & REPAIRS TO THE CAT 245. GIT IS SETTING UP GENERATORS AND PUMPS. BILL WILL HAVE LEAD IN TRENCH PERPENDICULAR TO PROPOSED WALL. ACHIEVING DEPTH REQUIRED AT STATION 25+05.

Required Testing Performed by Inspector or Others: _____
MEASURED THE WIDTH OF THE CAT 245 BUCKET CUTTING WING TO CUTTING WING WAS 3 FEET.

Visitors: _____

Signature: Timothy J. Imbrogno

McDonald - MaasClient Name: BROWNING-FERRIS INDUSTRIESProject Name: Slurry TRENCH CUTOFF WALLDate: NOVEMBER 10, 1990**RESIDENT INSPECTION REPORT**Report No.: 6Project Location: WINTHROP HARBOR LANDFILLOwner: BROWNING-FERRIS INDUSTRIESContractor: G I TPITTSBURGH, PASuperintendent: BILL CONEYBEER

Foreman: _____

Contract: _____

Weather: Sunny - BRISK WINDTemperature: HIGH 40's☐ Rain☐ SnowField Book Reference: FB 1 PAGE 7-12

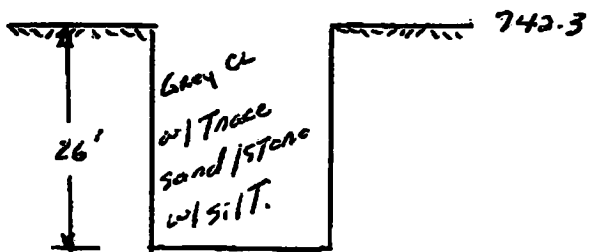
Work Completed: ARRIVED ON SITE BY 7:30 AND SHOT THE TOP
EQUIPMENT OF THE CONSTRUCTION PAD EVERY 10 FEET
1-245 CAT BACKHOE FROM 25+05 STATION TO STATION 23+00.
1-05 CAT DOZER BEGAN CUTTING LEAD IN TRENCH FOR SLURRY
1- MIXING PLANT CUTOFF WALL. LEAD IN WAS PERPENDICULAR
2- 4" PUMPS TO THE MAIN WALL. I NOTICED THE
1- Electric Generator OFF SET STAKES WERE SHIFTED TO
7-MEN THE NORTH 50 FEET. THEREFORE
WE CHANGED THE STATIONS AND SET
STATION 25+05 AT THE CORRECT LOCATION. THE
MIXER IS RECEIVING WATER FROM BEI POND
ALONG GHOON PAY ROAD & NINETH. THE MIXER IS RECEIVING
DATA: A 100 POUND BAG BENOTINE EVERY 15-20 SECONDS.
VISCOSITY, DENSITY ARE MONITORED ON BOTH ENDS OF THE

Comments: pumping. BACKFILL IS BEING MIXED BY DOZER
THE EXISTING MAT'L BEING REMOVED IS A GRAY LEAN CLAY w/ STONE. PULLED
SAMPLE OF BACKFILL FOR GRADATION IN SOIL LAB AND ALSO FIELD TESTING
HAS 71.9% PASSING. TRENCH SLURRY IS BEING TESTED FOR
REQUIRED TESTING PERFORMED BY INSPECTOR OR OTHERS: DENSITY, VISCOSITY 3X PER DAY
AT THE MIXER, AT PIPE OUTLET AND FROM TRENCH
FILTER PASS IS CONDUCTED ON THE TRENCH SLURRY.

Visitors: _____

Signature: Timothy J. Chas...

- TRENCH Profile 25+00 -



- Backfill Testing / Sampling -

Daily - Slump - Density - P₂₀₀ + Temp

Sampler for Soil for 100' linear Trench w/ Key - In mat'l / Bottom Mat'l every 100' of linear trench.

- TESTING of Trench Slurry -

3 Times per day at Mixer

Viscosity Density ~~Press~~ Temp

3 Times per day at Pipe outfall

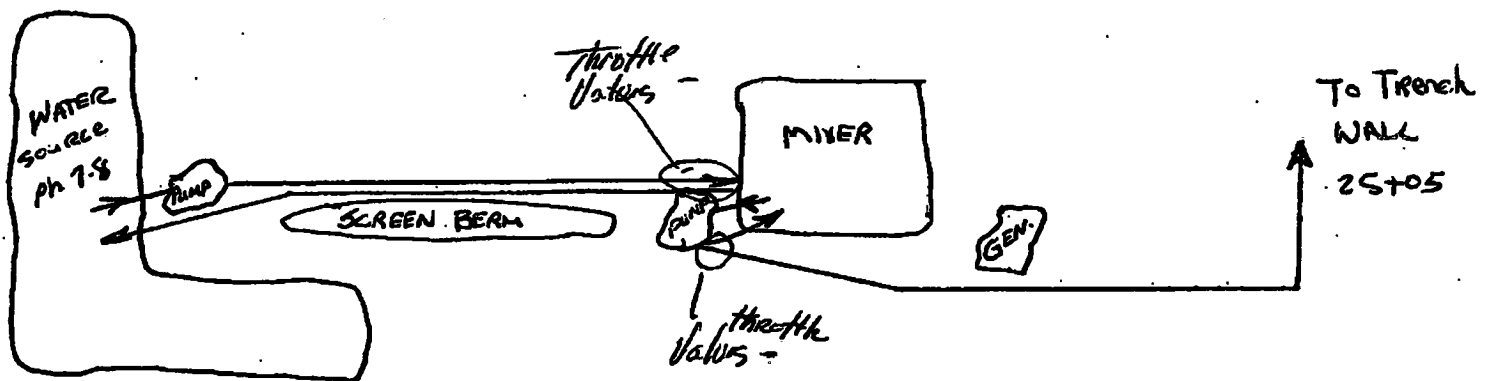
" " "

3 Time per day from Trench

" " Press "

- SITE SET-UP -

ALL LINES ARE 4" P HOPE WELDED TOGETHER w/ HOT PLATE
BLUE LINE ARE MAINS WITH Red LINES BEING
Circulation Lines. The Recycling is done BY a series of
Valves.



McDonald - Maas

Client Name: Browning-Ferris Industries
 Project Name: Slurry Trench Cut-off Wall
 Date: November 11, 1990

RESIDENT INSPECTION REPORTReport No.: 7

Project Location: Winthrop Harbor, Landfill
 Owner: BROWNING-FERRIS INDUSTRIES, INC.
 Contractor: B-I-T
PITTSBURGH, PA
 Superintendent: BILL CONEYBEER
 Foreman: _____

Contract: _____
 Weather: Over Cast - Cold - Rain
 Temperature: 30's windy
☒ Rain
☐ Snow
 Field Book Reference: FB-1 pg 12-15

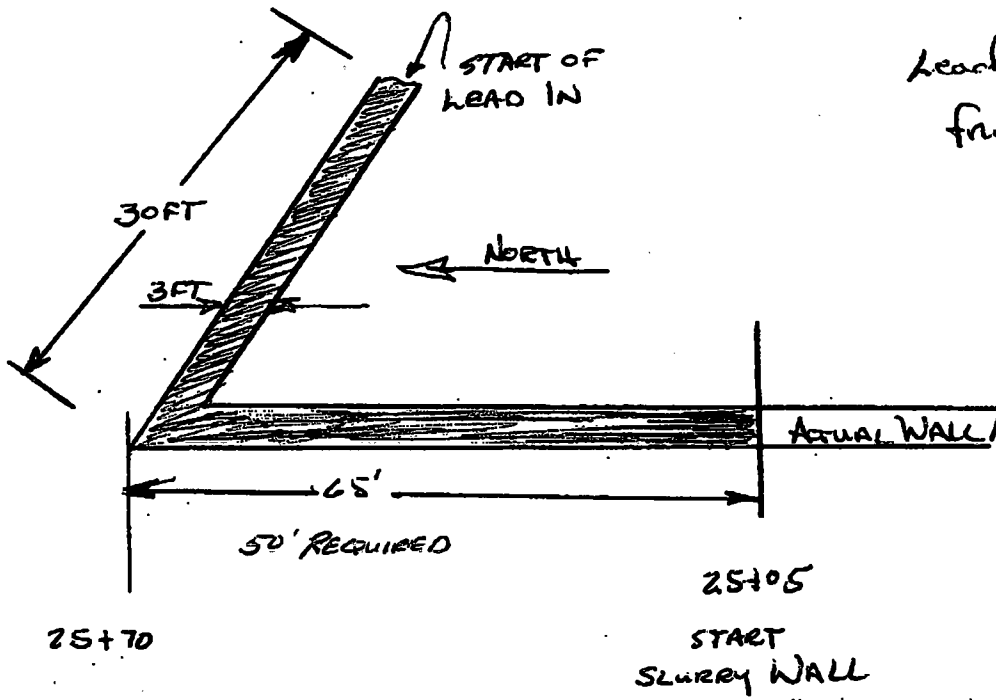
Work Completed: BEGAN Trench excavation at station 24+50 and
finishing at station 24+20. ALOT OF PROBLEMS WITH THE
SLURRY LINES BEING LEAD UP. THE 4" Ø SLURRY LINE HAD APPROX
2" OF ROTTEN ICE. BILL DIDN'T REALLY GET ANYTHING STARTED
UNTIL AFTER 11:30. BACKFILL OPERATION CONTINUING WITH
BACKFILL BEING PUSHED INTO THE LEAD IN TRENCH. Bentonite
- Equipment - Being added at a rate of 1-100 pound
1-245 Cat Backhoe Bay every 15-30 sec when everything
1-DS Cat Dozer is moving smoothly. Slurry is being
1- Fork Lift Sampled at mixer, trench and pipe. The
1- mixer Backfill was pulled and analyzed for grain size
2- pumps See Summary sheets.
 Delays: 8-men - Compennella Const. on site to do some minor
welding on stick of Backhoe 7:00-8:30. The lead in trench

Comments: was longer than what was specified we were
approximately 85 FEET from start of cut off wall station 25+05.

Required Testing Performed by Inspector or Others: Trench Slurry + Backfill -
See daily forms.

Visitors: NoneSignature: Timothy - I. Quinn

- LEAD IN TRENCH -



Lead in Trench Started
from Nothing to
26' Below Const. Pat

McDonald - Maas

Client Name: Browning Ferris Industries
 Project Name: Slurry Trench Cutoff Wall
 Date: November 12, 1990

RESIDENT INSPECTION REPORTReport No.: 8

Project Location: Winthrop Harbor Landfill
 Owner: Browning - Ferris Industries, Inc.
 Contractor: GIT
Pittsburgh, PA
 Superintendent: Bill Conroybeer
 Foreman: _____

Contract: _____
 Weather: Sunny Warm like Breeze
 Temperature: Mid-upper 40's
☐ Rain
☐ Snow
 Field Book Reference: PB1 pg 15-19.

Work Completed: Began excavation from Station 24+20 moving southward to Station 22+50 for a total of 170' linear Trench feet. Backfill operation was continuing as before on East side of the Cutoff Trench. The Backfilling continued until noon when Cat BS was broken in need of repairs. The Day Light of the Backfill Equipment was at 24+70 with Toe at 23+30.
 1- 245 Cat Backhoe A slope of 5.5:1. I talked with
 1- BS Cat Dozer Bill about adding clay Bentonite to the
 1- Fork Lift Backfill. He informed me that the
 1- Slurry Mixer pile drill meeting no clay Bentonite
 2- pumps - Gen would be placed according to B.F.I.
 7 men SAID I feel we need the Dry Bentonite
 Delays: AND will confirm this as soon as possible. I shot the
 E of the Construction PAs every 10 feet from Station 22+90 to 20+00.

Comments: Talk with Bill Parenteau - Asset operator digging deeper than what is actually required of 77.0 during entire day. I feel we should compensate contractor for 77.0 and above any thing below we will document but he shouldn't be compensated for.

Required Testing Performed by Inspector or Others: Slurry Testing was conducted in the Water Slurry 2% at the mixer, Trench and pipe due to working until 2:30. Sampled backfill @ 24+00 with BS-2 and also

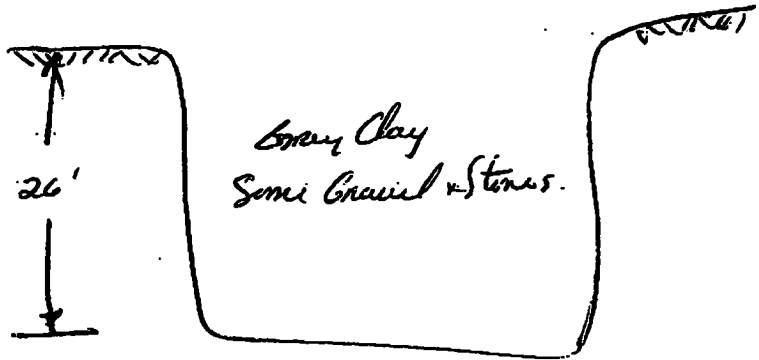
Visitors: The Key Material at 24+00 and 23+00.

Samples WH-Key-2, WH-Key-3.

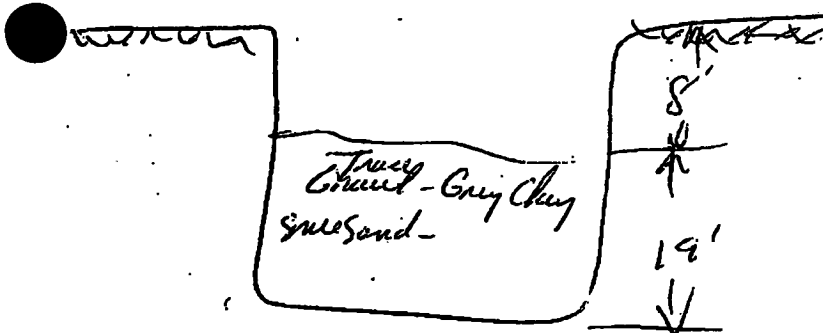
Signature: _____

- Soil Profile -

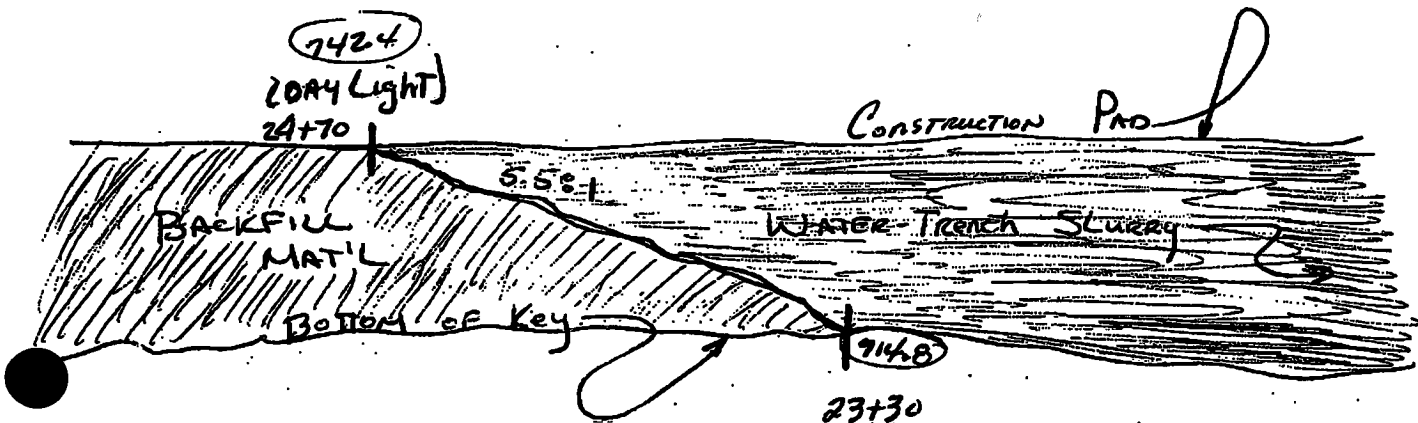
24+00



23+00



- Back Fill Profile -



McDonald - MaasClient Name: Browning-Ferris IndustriesProject Name: Slurry Trench Cut-off WallDate: November 13, 1990**RESIDENT INSPECTION REPORT**Report No.: 9Project Location: Winthrop Harbor LandfillOwner: Browning-Ferris Industries, Inc.Contractor: GITPittsburgh, PASuperintendent: Bill Convey/Beer

Foreman: _____

Contract: _____

Weather: Sunny - WarmTemperature: Low 50's☐ Rain☐ SnowField Book Reference: FB1 p920-26

Work Completed: Began excavation at station 22+50 moving southward from station to station 19+40. Excavating 310 feet of trench. Documentation of the key in trench was kept at a 10 foot interval and recorded from the top of the construction for backfilling operation continuous using

- Equipment - Both a D-5 Dozer and the D-8 Dozer.
1- CAT 245 Backhoe Trench Slurry is added to the backfill
1- D-8 CAT Dozer (Today) Mat'l and worked in. Day lighting
1- Fork Lift 1- D-5 Dozer at the backfill remains at 24+70
1- Slurry Mixer during the better part of the day
2- Pumps & Generator Did backfill soil profile @ 2:30
5 men GIT - 1 Bossi - 2 Union. and 4:30 (See Back of page).

Delays: Shot the top of the construction pad from 19+90 to 14+30 every 10 feet. Ran a gradation on backfill Mat'l from station

Comments: 23+00 and found 46.5% passing P-200. Also pulled a sample of key mat'l. and conducted a gradation it had a P-200 content of 40%. Ran Trench Slurry at site see Daily hand out / Summary sheet.

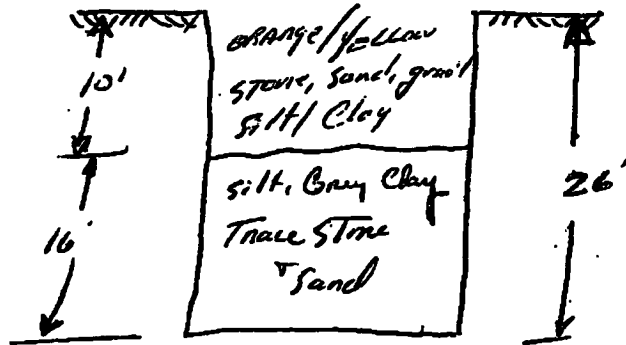
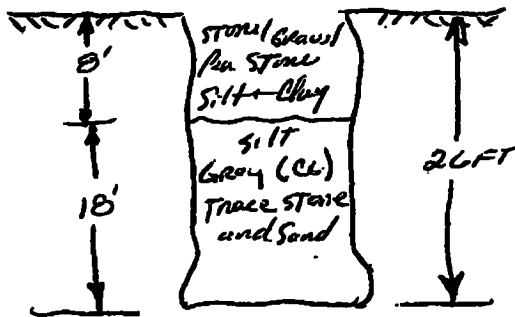
Required Testing Performed by Inspector or Others: Pulled Key Samples @ 20+00, 21+00 WH-KEY-4, WH-KEY-5. Obtained the backfill sample WH-BF-3 + WH-BF-4 @ station 22+00.

Visitors: John Dixon - BFISignature: Timothy J. Ch...

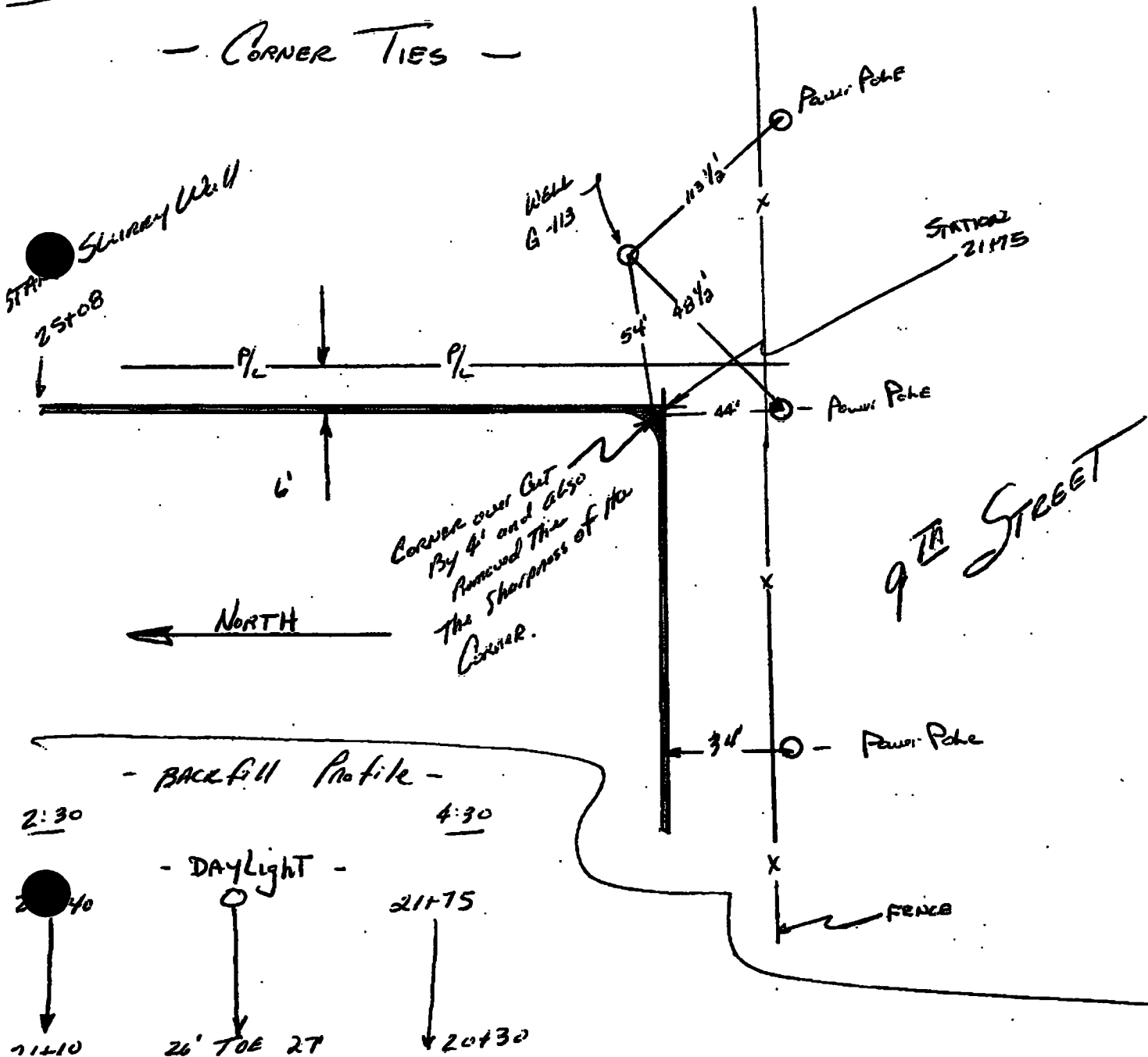
Soil Profile

21+75

20+50



- CORNER TIES -

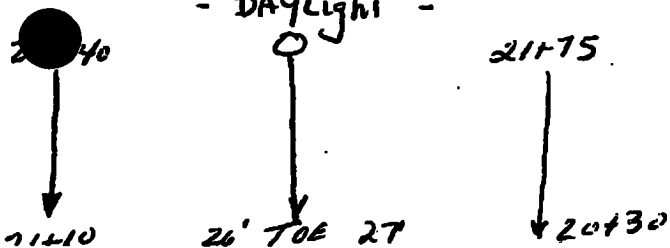


- BACKFILL Profile -

2:30

4:30

- DAYLIGHT -



McDonald - MaasClient Name: Browning Ferris IndustriesProject Name: Sewer Trench Cut Off WallDate: November 14, 1990**RESIDENT INSPECTION REPORT**Report No.: 10Project Location: Winthrop Harbor LandfillOwner: BROWNING-FERRIS INDUSTRIESContractor: G. I. T.PITTSBURGH, P.A.Superintendent: Bill Convey/BEER

Foreman: _____

Contract: _____

Weather: Sunny - Warm - LT. WindTemperature: Mid 50's☐ Rain☐ SnowField Book Reference: FBI page 27-30

Work Completed: Began Construction from Station 19+40 moving west along 9TH STREET. The Union people from local 150 were on site during day. They state that an dike is required, pump operator and Grant's Dozer must have an operator. Explained to Bill P. that Dry Bentonite must be added. I said we would need approximately 30-32 Ton of Bentonite Dry which will be added to the Backfill.

- Equipment - Documentation of the Key

1- 245 CAT Backhoe w/ Ciler was done every 10 FEET measuring from the top of the construction

1- 05 CAT DOZER

1- 08 CAT DOZER (Rossi) ran to the Key bottom. Backfill

2- 6" pumps was continued to be mixed using

Delays: 1- Fork Lift both dozers. The Dry Bentonite was

9 min. placed using the 973 Cat Crawler of BEI.

Comments: GIT broke 100 lb bags into bucket of crawler. It was placed at a rate of 2 pallets / 100 FEET of Trench.

Required Testing Performed by Inspector or Others: Pulled Samples from Key WH-Key-7, WH-Key-8, WH-Key-9. Backfill Samples at station 21+00 & 20+00 respectively. WH-BF-5 & WH-BF-6 were obtained. Slurry in Trench was also tested.

Visitors: Mike Williams BEI

Signature:

— BACKfill Profile —

11:45
STATION 21+40

0 = DAYLIGHT = 0

4:30
STATION 20+40

19+60

19+40

19+20

19+00

27'

Toe

25'

17+40

McDonald - MaasClient Name: Browning-Ferris IndustriesProject Name: Slurry-Trench CutOff WallDate: November 15, 1990**RESIDENT INSPECTION REPORT**Report No.: 11Project Location: Winthrop Harbor LandfillOwner: BROWNING-FERRIS INDUSTRIESContractor: GITPITTSBURGH, PASuperintendent: Bill Coney/Boer

Foreman: _____

Contract: _____

Weather: Sunny - Very WindyTemperature: MID 60's☐ Rain☐ SnowField Book Reference: FB 1 pg 32-37

Work Completed: BEGAN excavation AT station 16+90 and moving TO THE WEST. A STATION 16+70 10 FEET BELOW TOP OF CONSTRUCTION PAD SEVERAL PIECES OF CONCRETE WAS REMOVED. THE KEY IN DOCUMENTATION WAS MEASURED EVERY 10 FEET TO TOP OF THE CONSTRUCTION PAD. HUCKLE ELECTRIC ON SITE TO PROP power line to the STORAGE TANK. NO TRENCH slurry was added to the Trench But the Slurry was mixed and pumped TO BE USED FOR BACKFILL MIXING. Trench Slurry Testing was CONDUCTED AT THE MIXER DURING DAY. BACKFILLING OPERATION CONTINUES WITH JUST THE D8 CAT DOZER MIXING THE BACKFILL. THE 973 CAT CRANLER IS HAULING THE Dry Bentonite AT A RATE OF 2 pallets / 100 FEET OF TRENCH WHERE EACH PALLET WEIGHS 2 tons (4000 lbs).

Comments: Backhoe down from 2:15 til 4:00 due to a small oil leak we stopped before it BLEW.

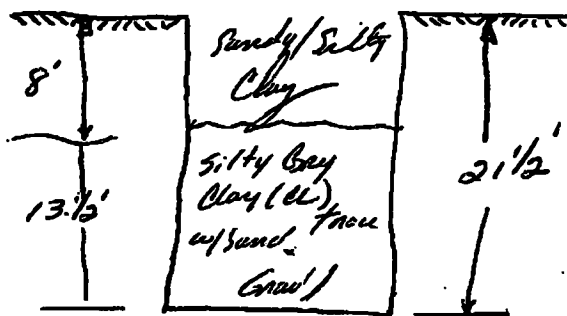
Required Testing Performed by Inspector or Others: PUSH Shelby Tubes at 23+00, 21+00, & 19+00 in the BACKFILL. Pulled Samples of the Key/IN MAT'L AT STATION 19+00 WH-BF-7. Key Samples were pulled @

Visitors: 16+00, 15+00 WH-Key-10; WH-Key-11

Signature: _____

Imothy J. Ambrosio

- Soil Profile - 16+00



- BACKFILL PROFILE 1483

11:30

4:30

19+50

DAYLIGHT

17+75

16+30

TUB

15+40

- Equipment -

- 1 - 245 Cat Backhoe
- 1 - D8 Cat Dozer (Rossi)
- 1 - Slurry Mixer
- 1 - Fork Lift
- 2 - 6" pumps
- 1 - 973 Cat Crawler (BFI)
- 7 men Git, 1-Rossi, 1-BFI, 2 Union

- Bill Coneybear asked where we can force Trench Slurry out when the Time arrives. According to BFI They would allow it to be forced into the secured cell #2 so long as we contained the Slurry.

McDonald - MaasClient Name: Browning-Ferris IndustriesProject Name: Slurry Trench Cut Off WallDate: November 16, 1990**RESIDENT INSPECTION REPORT**Report No.: 12Project Location: Winthrop Harbor LandfillOwner: BROWNING-FERRIS INDUSTRIESContractor: GIT
PITTSBURGH, PASuperintendent: Bill Coney/BEER

Foreman: _____

Contract: _____

Weather: Overcast / CloudyTemperature: High 40's☐ Rain☐ SnowField Book Reference: FBI pg 37-42

Work Completed: Began Trench excavation at 14:30 moving around corner to tie with existing cut off wall. Key in documentation remained by documentation and 10' measured from top of construction pad to bottom of key. Shot top of construction pad from 14:30 to 13:25. Just prior to tie with existing cut off wall a seam of garbage was encountered. It was removed and hauled away from construction area by BFI, using backhoe and scrapers. Backfill mixing has been by using the D8 Dozer - Equipment - and also 973 Crawler. Dry Bentonite 1- 245 Cat Backhoe was still being used at a rate of 1- D8 Cat Dozer 2 pallets / 100' Trench. The wall 1- Slurry Mixer was excavated around the huz. Storage

Delays: 1- Forklift Tank w/ a radius of 57' measured from 2- 6" Pumps The power pole.

1- 973 Cat Crawler

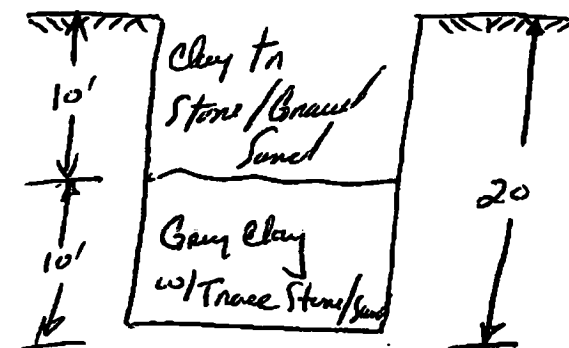
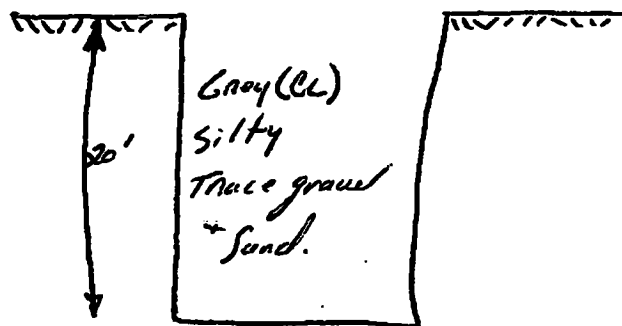
Comments: Git 6 men Pushed Shelby Tube @ station 17:00
BFI 1 man + 15:00 WH-BF-9 + WH-BF-11
Union - 2 men
Rossi - 1 man

Required Testing Performed by Inspector or Others: pulled Key Sample WH-15412 @ station 14:00 Backfill Samples obtained @ 18:00, 17:00, & 16:00
Samples WH-BF-8, WH-BF-9, WH-BF-10. Trench Slurry Tested at mixer

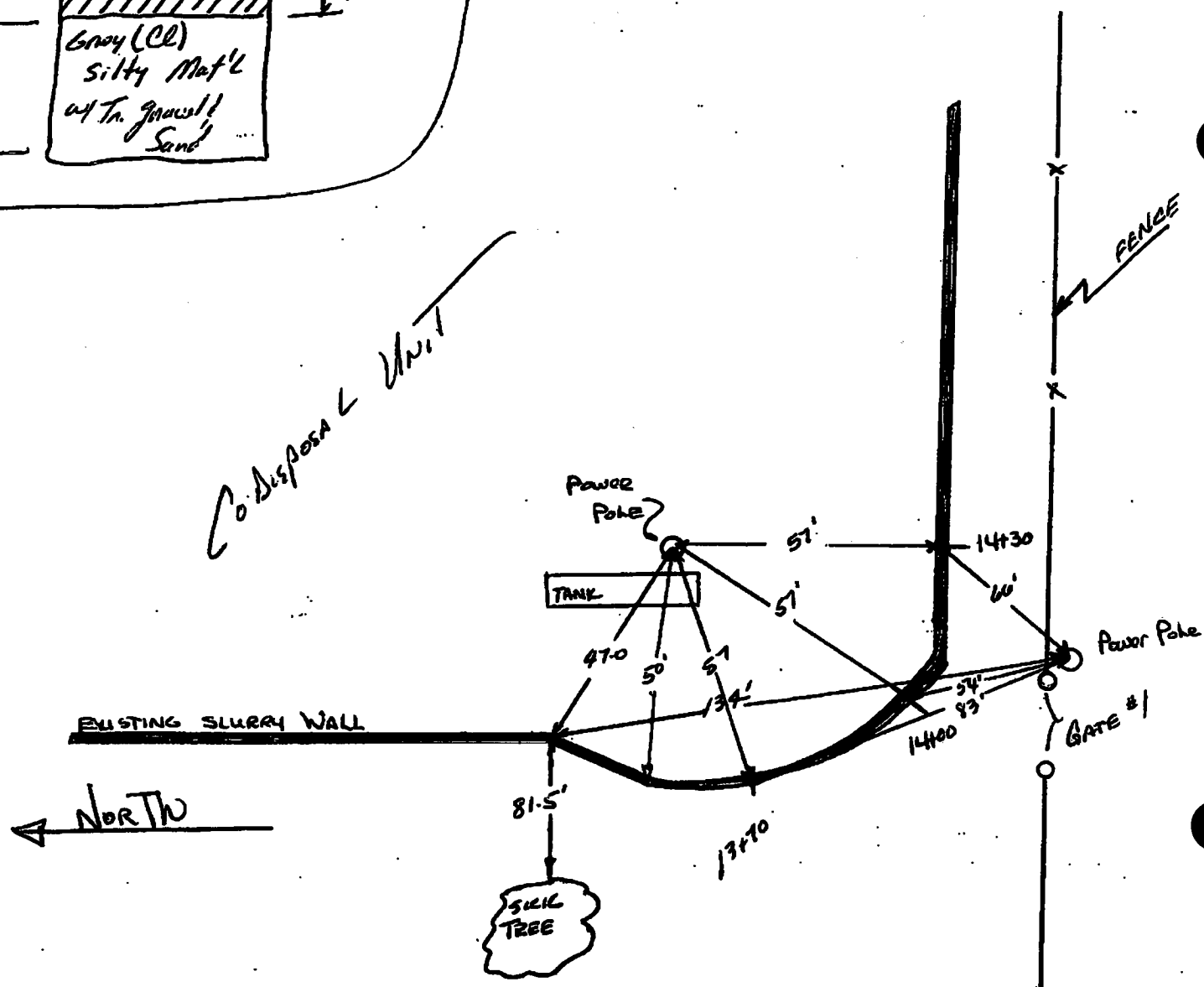
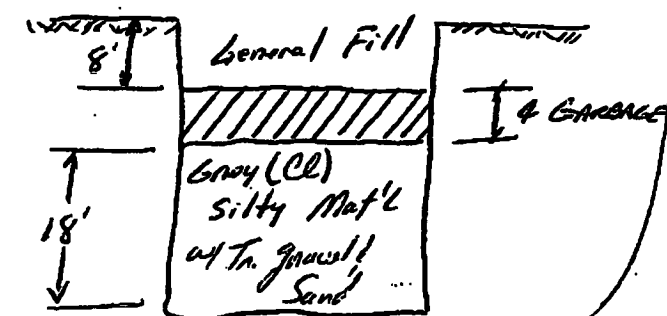
Visitors: _____

Signature: Timothy J. O'Hara

14700



AT KEY IN 13+25



McDonald - MaasClient Name: BROWNING-FERRIS INDUSTRIESProject Name: Slurry Trench Cut-off WallDate: NOVEMBER 17, 1990**RESIDENT INSPECTION REPORT**Report No.: 13Project Location: WINTHROP HARBOR LANDFILL

Contract: _____

Owner: BROWNING-FERRIS INDUSTRIESWeather: Sunny - CoolContractor: GITTemperature: Low 50'sPITTSBURGH, PA☐ RainSuperintendent: BILL CONYBEER☐ Snow

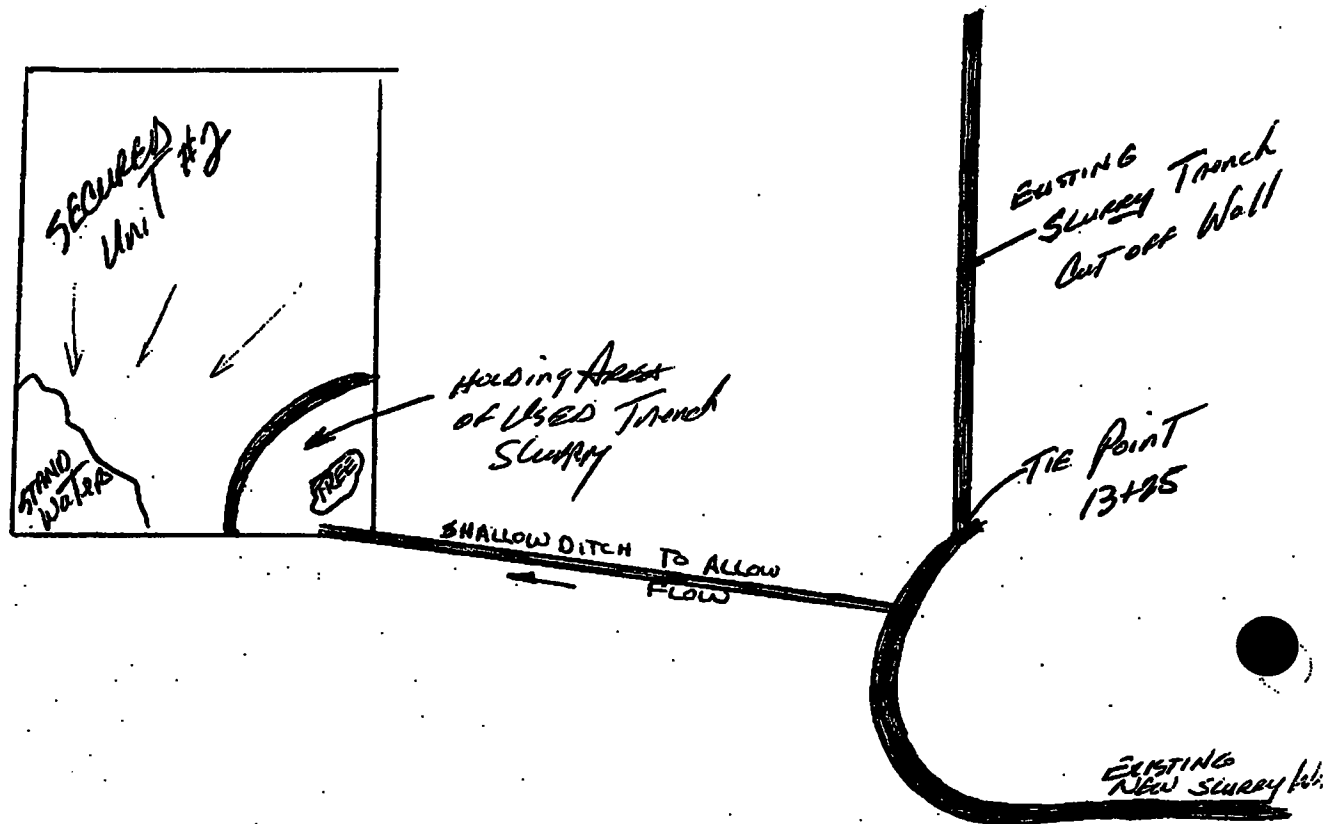
Foreman: _____

Field Book Reference: FB1 pg 43 - 45Work Completed: Backhoe working at backfill mat'l pulling it- Equipment - into the Trench such that Dozers would have1-245 CAT BackhoeTo work around the radius area.1- D8 CAT Dozer (Rossi)973 continues to haul the Dry1- Fork LiftBentonite into the backfill at1- GeneratorRate of 2 pallets (2000 lbs)2- 6" pumpsper 100' of Trench.1- 973 CAT Crawler (BFI)The Trench slurry is allowed to5 men GITLeave the excavation by a ditch1- Rossicut from the Slurry excavation to1- BFI (Charles)the Secured unit #2.2- UnionBFI began capping of the wall fromStation 05 to 05.A TOTAL of 32 Ton of Dry Bentonite wasComments: Placed during the Backfilling operation.Required Testing Performed by Inspector or Others: Sample pulled of backfill
WH-BF-11 Bag & Tube. Mixer was operating and were obtaining
Test Results on the Slurry

Visitors: _____

Signature: Timothy J. Olinos

- Removal / Storage of Trench Slurry -



Appendix F

Quality Assurance for Bentonite



P.O. Box 42842

HOUSTON, TEXAS 77242

713 672-1310

TELEX 168743

November 1, 1990

Mr. Tom Kaniecki
Ground Improvement Techniques
Pittsburgh, PA 15235

LETTER OF CERTIFICATION

This is to certify that the product FEDERAL JEL 90
as manufactured by M-I DRILLING FLUIDS COMPANY conforms to
the requirements as specified in API-13A SECTION 4.

A handwritten signature in dark ink, appearing to read 'Clay Winnard', is written above the printed name.

Clay Winnard

Appendix G

Laboratory Test Results

for

Key-In Materials

Foth & Van Dyke

Client: McDonald-Maas and Assoc. Scope I.D.: 90M86
 Project: Slurry Wall-BFI Zion Facility Page: 1
 Prepared by: Karl Schuldes Date: 11/29/90
 Checked by: *Perry O. Kepler* Date: 1/3/91

REPORT OF:
SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: Key-1

Test Performed In General Accordance Of: ASTM: D422**General Data:**

Sample Location: Sta. 23+00 Date Sampled: 11/12/90
 Sample Number: WH-KEY-3 Dated Received: 11/19/90
 Depth of Sample: Source of Sample: In Place
 Sampled by: Tim Ambrosius of McDonald-Maas Munsell Color Code: 10 YR. 3/2
 Sample Designated For: Verification of Soil

Laboratory Data:

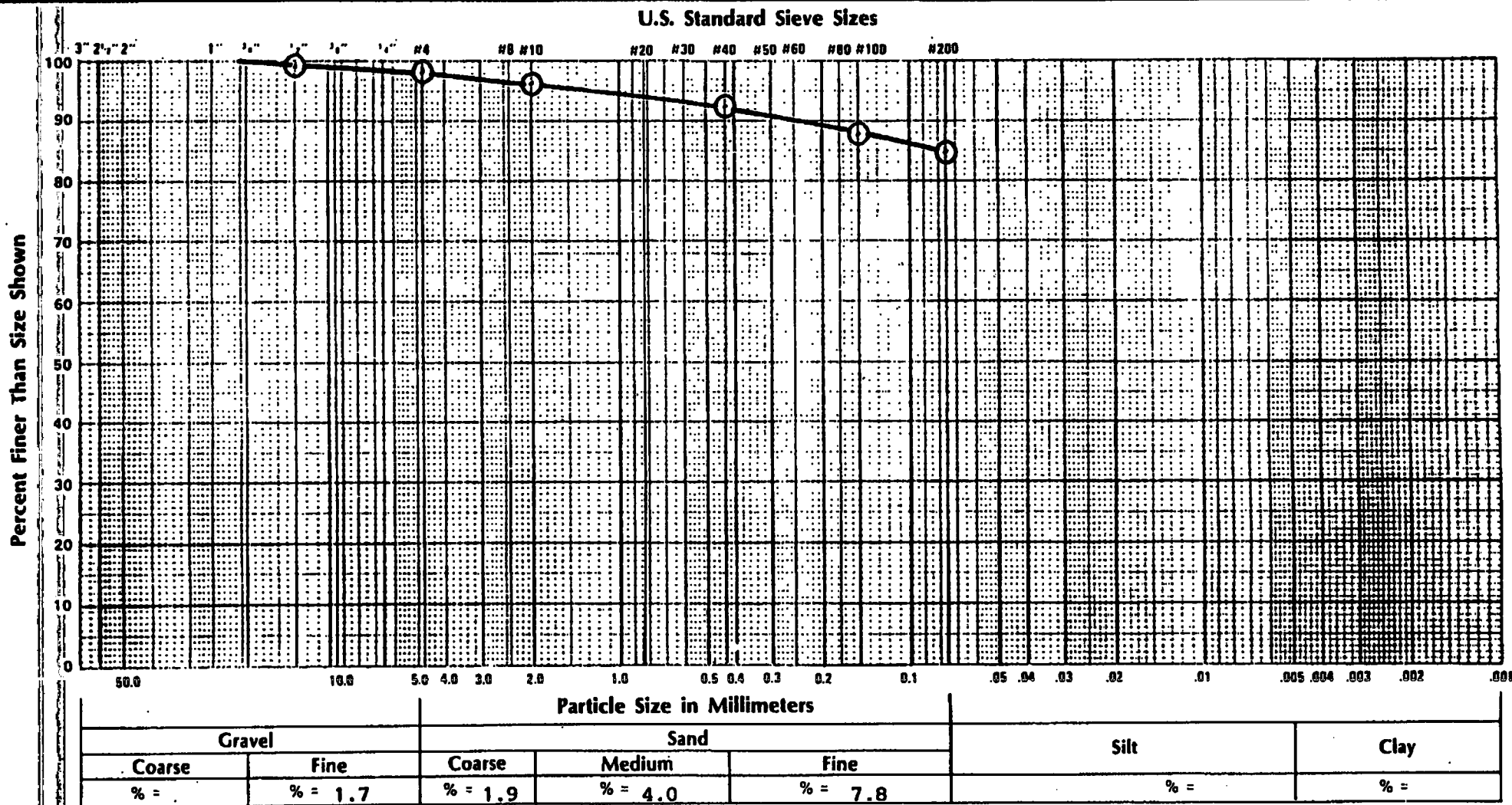
Date Tested November 29 to December 4, 1990 24 Hrs. Turn Around Yes ☒ No
 Test Performed by: KAS Washed Gradation X Yes No

Weight of Test Sample 364.3 Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½					
1					
¾	0	0	100		
½	2.8	0.8	99.2		
⅜	0	0	99.2		
#4	3.1	0.9	98.3		
10	6.8	1.9	96.4		
40	14.5	4.0	92.4		
100	16.8	4.6	87.8		
200	11.9	3.3	84.5	50-100	
Pan	308.2	84.6			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE



Location Sampled: WH-KEY-3: STA. 23+00 Elev. or Depth: _____ Date Sampled: 11/12/90

Sample Source: In Place Clay @ Keyway Sampled Moisture Content (%): 16.6 Report No.: KEY-1

Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, very dark grayish brown (CL)

Atterberg Limits: LL 28.3 PL 14.5 PI 13.8

Munsell Color Code: 10 YR. 3/2

Date Received: 11/19/90

Coefficients: C_u = _____ Cu = _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86

Project: Slurry Wall-BFI Zion Facility Page: 2

Prepared by: Robert Rouse Date: 12/31/90

Checked by: Perry D. Kepler Date: 1/3/91

Foth & Van Dyke

Client: McDonald-Maas and Assoc. Scope I.D.: 90M86
 Project: Slurry Wall-BFI Zion Facility Page: 1
 Prepared by: Karl Schuldes Date: 11/29/90
 Checked by: Perry O. Kepler Date: 1/3/91

REPORT OF:
SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: KEY-2

Test Performed In General Accordance Of: ASTM: D422**General Data:**

Sample Location: STA. 21+00 Date Sampled: 11/13/90
 Sample Number: WH-KEY-5 Dated Received: 11/19/90
 Depth of Sample: Source of Sample: In Place
 Sampled by: Tim Ambrosius of McDonald-Maas Munsell Color Code: 10 YR. 3/2
 Sample Designated For: Verification of Soil

Laboratory Data:

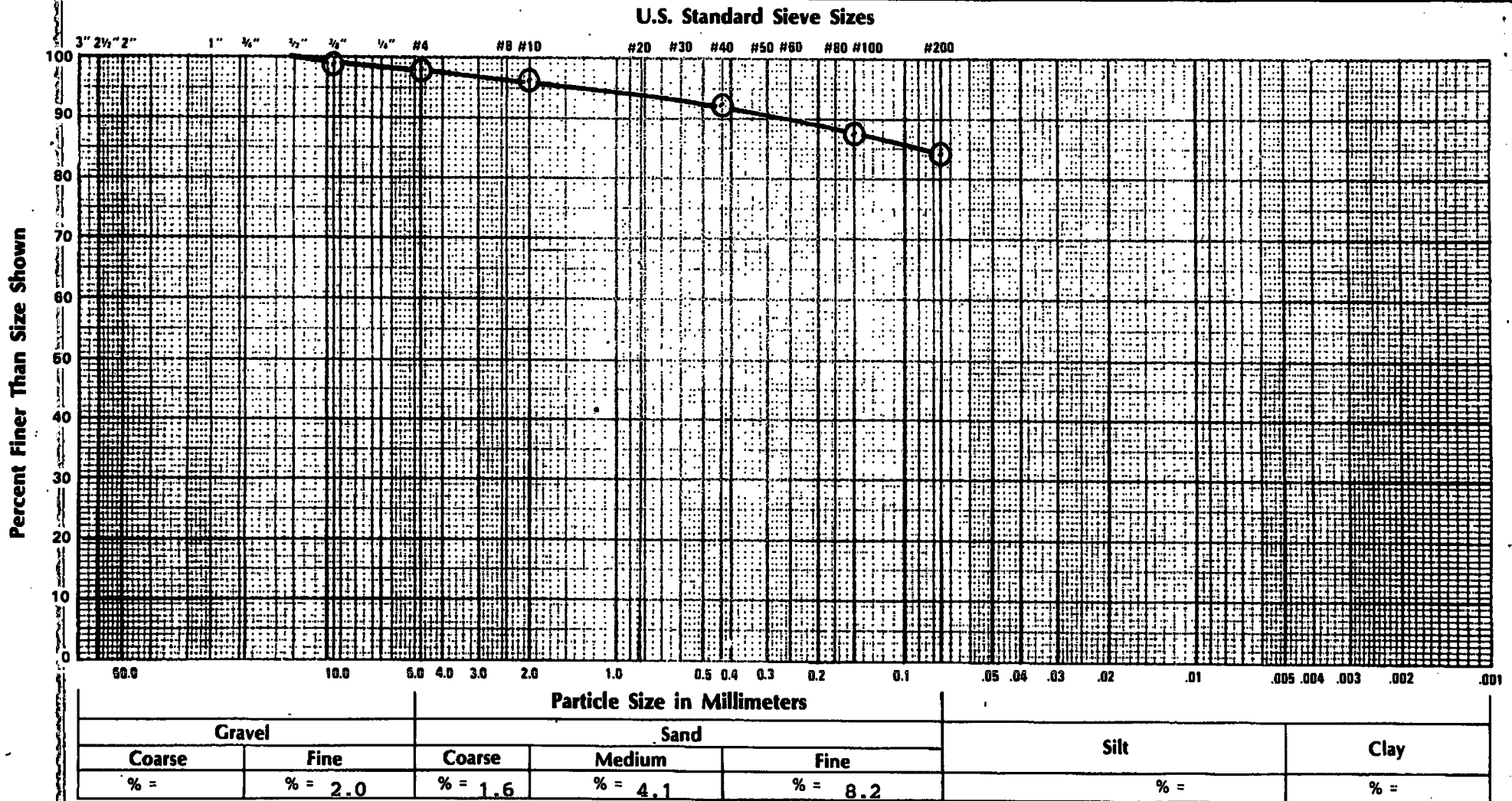
Date Tested November 29 to December 4, 1990 24 Hrs. Turn Around Yes ☒ No
 Test Performed by: KAS Washed Gradation ☒ Yes No

Weight of Test Sample 453.4 Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½"					
1"					
¾"					
1/2"	0	0	100		
3/8"	4.7	1.0	99.0		
#4	4.7	1.0	98.0		
#10	7.3	1.6	96.4		
#40	18.5	4.1	92.3		
#100	21.1	4.7	87.6		
#200	15.5	3.4	84.2	50-100	
Pan	381.3	84.1			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE



Location Sampled: WH-KEY-5: STA. 21+00 Elev. or Depth: _____ Date Sampled: 11/13/90

Sample Source: In Place Clay @ Keyway Sampled Moisture Content (%): 17.6 Report No.: KEY-2

Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, very dark grayish brown (CL)

Atterberg Limits: LL 28.1 PL 14.3 PI 13.8

Munsell Color Code: 10 YR. 3/2

Date Received: 11/19/90

Coefficients: C_u _____ Cu= _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86

Project: Slurry Wall-BFI Zion Facility Page: 2

Prepared by: Robert Rouse Date: 12/31/90

Checked by: [Signature] Date: 3/91

Foth & Van Dyke

Client: McDonald-Maas and Assoc. Scope I.D.: 90M86
 Project: Slurry Wall-BFI Zion Facility Page: 1
 Prepared by: Karl Schuldes Date: 11/29/90
 Checked by: Perry D. Kaplan Date: 1/3/91

REPORT OF:
SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: KEY-3

Test Performed In General Accordance Of: ASTM: D422**General Data:**

Sample Location: STA. 18+35 Date Sampled: 11/14/90
 Sample Number: WH-NW-1 Dated Received: 11/19/90
 Depth of Sample: Source of Sample: In Place
 Sampled by: Tim Ambrosius of McDonald-Maas Munsell Color Code: 10 YR. 3/2
 Sample Designated For: Verification of Soil

Laboratory Data:

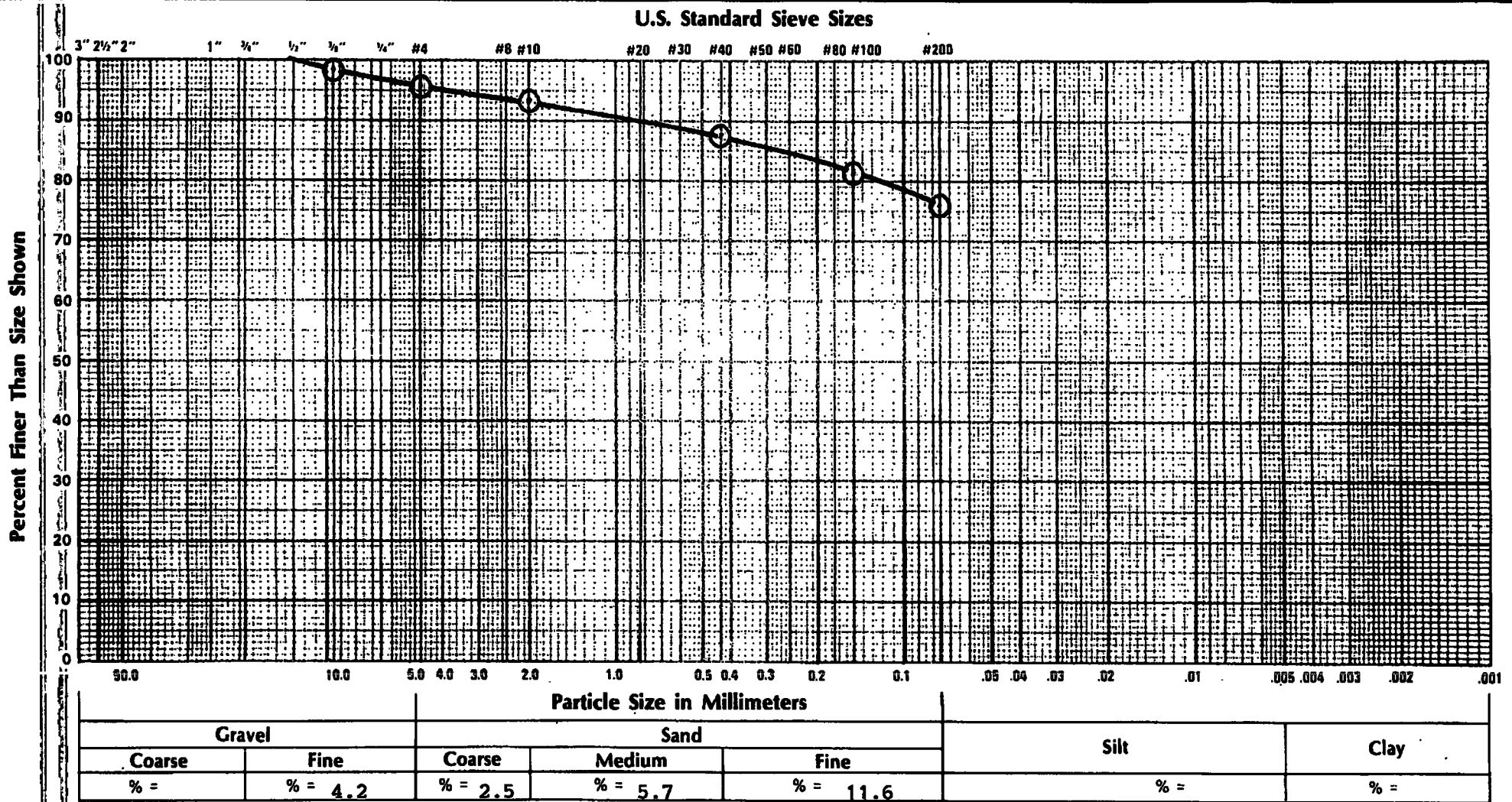
Date Tested November 29 to December 4, 1990 24 Hrs. Turn Around Yes X No
 Test Performed by: KAS Washed Gradation X Yes No

Weight of Test Sample 263.4 Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½					
1					
¾					
½	0	0	100		
3/8	4.0	1.5	98.5		
#4	7.2	2.7	95.8		
10	6.6	2.5	93.3		
40	15.1	5.7	87.6		
100	16.3	6.2	81.4		
200	14.1	5.4	76.0	50-100	
Pan	200.1	76.0			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE



Location Sampled: WH-NW-1 @ STA. 18+35 Elev. or Depth: _____ Date Sampled: 11/14/90

Sample Source: In Place Clay @ Keyway Sampled Moisture Content (%): 14.4 Report No.: KEY-3

Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, a little gravel, very dark grayish brown (CL/CL-ML)

Atterberg Limits: LL 22.9 PL 12.8 PI 10.1

Munsell Color Code: 10 YR. 3/2

Date Received: 11/19/90

Coefficients: C_u = _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86

Project: Slurry Wall-BFI Zion Facility Page: 2

Prepared by: Robert Rouse Date: 12/31/90

Checked by: Rory D. Kephart Date: 3/91

Foth & Van Dyke

Client: McDonald-Maas and Assoc. Scope I.D.: 90M86
 Project: Slurry Wall-BFI-Zion Facility Page: 1
 Prepared by: Karl Schuldes Date: 11/29/90
 Checked by: Perry D. Kaplan Date: 1/3/91

REPORT OF:
SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: **KEY-4**Test Performed In General Accordance Of: ASTM: D422**General Data:**

Sample Location: **STA. 18+00** Date Sampled: **11/14/90**
 Sample Number: **WH-KEY- 8** Dated Received: **11/19/90**
 Depth of Sample: Source of Sample: **In Place**
 Sampled by: **Tim Ambrosius of McDonald-Maas** Munsell Color Code: **10 YR. 3/2**
 Sample Designated For: **Verification of Soil**

Laboratory Data:

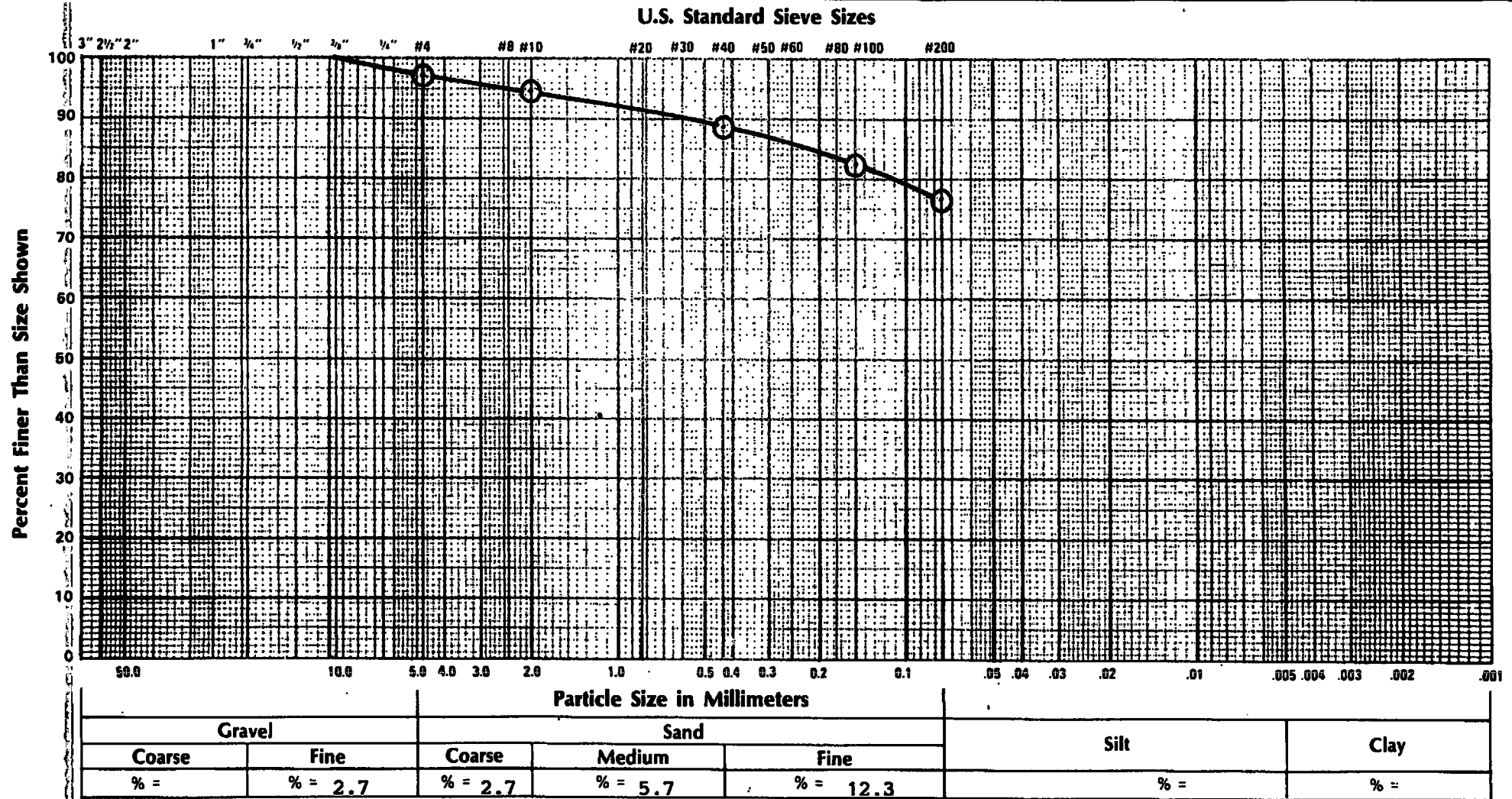
Date Tested **November 29 to December 4, 1990** 24 Hrs. Turn Around Yes **X** No
 Test Performed by: **KAS** Washed Gradation **X** Yes No

Weight of Test Sample **491.3** Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½					
1					
¾					
½					
3/8	0	0	100		
#4	13.3	2.7	97.3		
10	13.4	2.7	94.6		
40	27.9	5.7	88.9		
100	31.8	6.5	82.4		
200	28.7	5.8	76.6	50-100	
Pan	376.2	76.6			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE



Location Sampled: WH-KEY-8; STA. 18+00 Elev. or Depth: _____ Date Sampled: 11/14/90

Sample Source: In Place Clay @ Keyway Sampled Moisture Content (%): 14.2 Report No.: KEY-4

Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, very dark grayish brown (CL/CL-ML)

Atterberg Limits: LL 23.4 PL 13.8 PI 9.6

Munsell Color Code: 10 YR. 3/2

Date Received: 11/19/90

Coefficients: Cc _____ Cu= _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86

Project: Slurry Wall-BFI Zion Facility Page: 1

Prepared by: Robert Rouse Date: 12/31/90

Checked by: Perry D. Keple Date: 3/91

Foth & Van Dyke

Client: McDonald-Maas and Assoc. Scope I.D.: 90M86
 Project: Slurry Wall-BFI Zion Facility Page: 1
 Prepared by: Karl Schuldes Date: 11/29/90
 Checked by: Perry O. Kaplan Date: 1/3/91

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: **KEY-5**Test Performed In General Accordance Of: ASTM: D422**General Data:**

Sample Location: **STA. 15+00** Date Sampled: **11/15/90**
 Sample Number: **WH-KEY-11** Dated Received: **11/19/90**
 Depth of Sample: Source of Sample: **In Place**
 Sampled by: **Tim Ambrosius of McDonald-Maas** Munsell Color Code: **10 YR. 3/2**
 Sample Designated For: **Verification of Soil**

Laboratory Data:

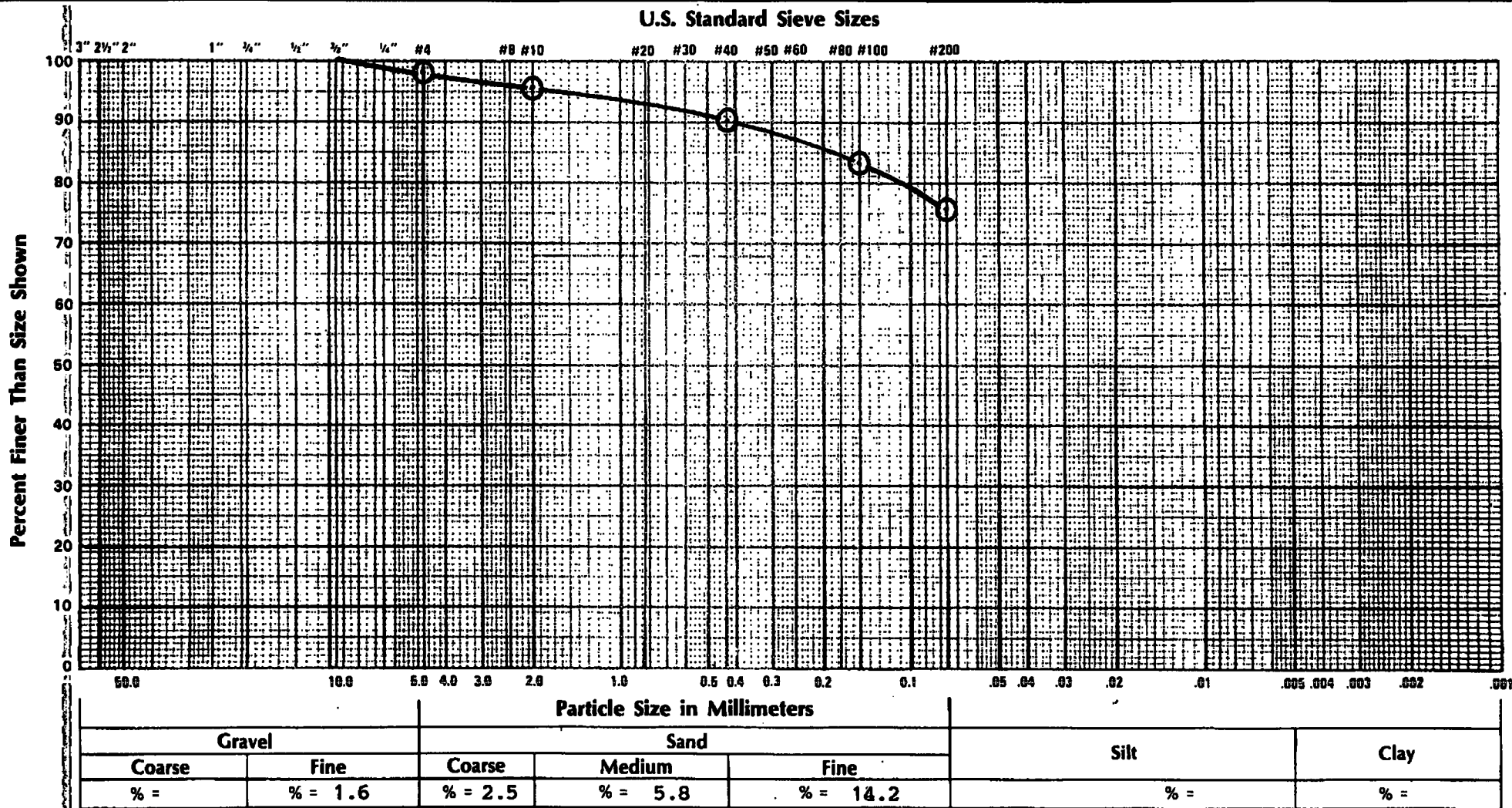
Date Tested **November 29 to December 4, 1990** 24 Hrs. Turn Around Yes ☒ No
 Test Performed by: **KAS** Washed Gradation X Yes No

Weight of Test Sample 349.1 Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½					
1					
¾					
½					
3/8	0	0	100		
#4	5.7	1.6	98.4		
10	8.7	2.5	95.9		
40	20.3	5.8	90.1		
100	24.0	6.9	83.2		
200	25.2	7.2	76.0	50-100	
Pan	265.0	75.9			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE



Location Sampled: WH-KEY-11; STA. 15+00 Elev. or Depth: _____ Date Sampled: 11/15/90

Sample Source: In Place Clay @ Keyway Sampled Moisture Content (%): 14.1 Report No.: KEY-5

Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, very dark grayish brown (CL/CL-ML)

Atterberg Limits: LL 22.1 PL 12.9 PI 9.2

Munsell Color Code: 10. YR. 3/2

Date Received: 11/19/90

Coefficients: Cc _____ Cu= _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86

Project: Slurry Wall-BFI Zion Facility Page: 2

Prepared by: Robert Rouse Date: 12/31/90

Checked by: Perry O. Kaplan Date: 1/9/91

R 001500

Foth & Van Dyke

Client: McDonald-Maas and Assoc. Scope I.D.: 90M86
 Project: Slurry Wall-BFI Zion Facility Page: 1
 Prepared by: Karl Schuldes Date: 11/29/90
 Checked by: Perry V. Kepler Date: 1/3/91

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: KEY-6

Test Performed In General Accordance Of: ASTM: D422**General Data:**

Sample Location: STA. 14+00 Date Sampled: 11/16/90
 Sample Number: WH-KEY-12 Dated Received: 11/19/90
 Depth of Sample: Source of Sample: In Place
 Sampled by: Tim Ambrosius of McDonald-Maas Munsell Color Code: 10 YR. 3/2
 Sample Designated For: Verification of Soil

Laboratory Data:

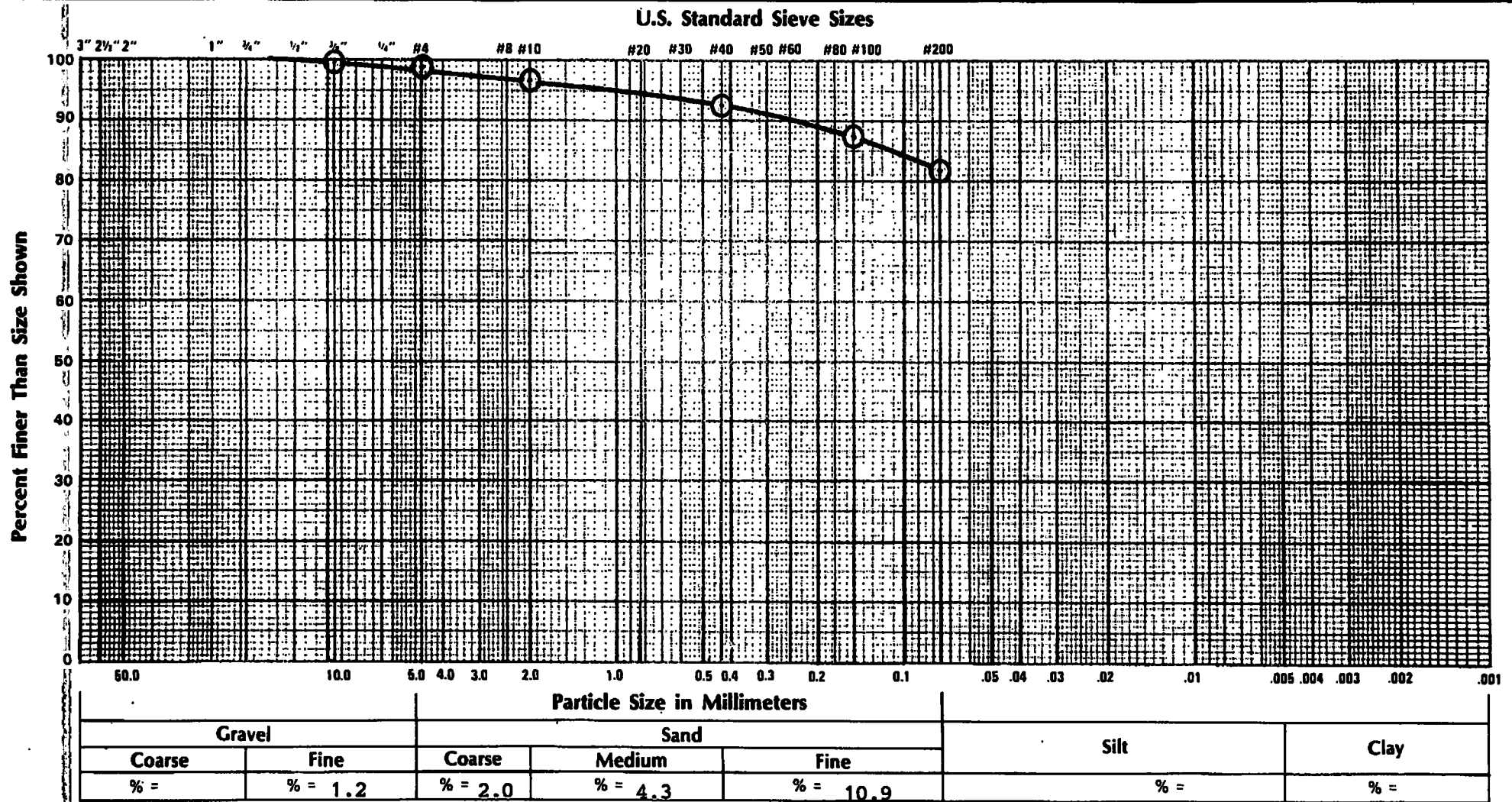
Date Tested November 29 to December 8, 1990 24 Hrs. Turn Around Yes ☒ No
 Test Performed by: KAS Washed Gradation X Yes No

Weight of Test Sample 379.2 Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½"					
1"					
¾"					
1/2"	0	0	100		
3/8"	1.5	0.4	99.6		
#4	3.1	0.8	98.8		
10	7.6	2.0	96.8		
40	16.2	4.3	92.5		
100	19.7	5.2	87.3		
200	21.4	5.6	81.7	50-100	
Pan	309.3	81.6			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE



Location Sampled: WH-KEY-12: STA. 14+00 Elev. or Depth: _____ Date Sampled: 11/16/90

Sample Source: In Place Clay @ Keyway Sampled Moisture Content (%): 15.3 Report No.: KEY-6

Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, very dark grayish brown (CL)

Atterberg Limits: LL 26.0 PL 14.1 PI 11.9

Munsell Color Code: 10 YR. 3/2

Date Received: 11/19/90

Coefficients: C_u = _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86

Project: Slurry Wall-BFI Zion Facility Page: 2

Prepared by: Robert Rouse Date: 12/31/90

Checked by: Perry D. Kephart Date: 1/91

Appendix H

Laboratory Test Results

for

Backfill

REPORT TO: Foth & VanDyke
2737 South Ridge Road
Green Bay, WI 54307-9012

TEST DATA
R 001504

DATE: 1-9-91

LAB. NO. 4800-91-176

Sample No.	WH-BF-3	WH-BF-5	WH-BF-9
Location	Slurry Wall	Slurry Wall	Slurry Wall
Type of Sample	Thin Wall	Thin Wall	Thin Wall
Soil Classification (ASTM:D2487)			
In-Place Moisture Content (%)			
Moisture-Density Relation of Soil (ASTM:D698)			
Max. Dry Density (PCF)			
Optimum Moisture Content (%)			
Permeability Test			
Trial No.	6-7	6-7	6-7
Type of Test	Falling Head	Falling Head	Falling Head
Type of Specimen	Undisturbed	Undisturbed	Undisturbed
Specimen Height (inches)	2.56	2.78	2.74
Specimen Diameter (inches)	2.82	2.85	2.85
Dry Density (PCF)	102.7	92.9	92.2
Percent of Max. Density	-	-	-
Moisture Content (%)	26.4	30.4	29.7
Max. Head Differential (cm)	152.4	152.4	152.4
Confining Pressure (Effective - PSF)	2.0	2.0	2.0
Water Temperature (°C)	19	19	19
Coefficient of Permeability K @ 20°C (cm/sec)	1.9×10^{-8}	2.2×10^{-8}	3.1×10^{-8}
K @ 20°C (d/min)	3.7×10^{-8}	4.3×10^{-8}	6.1×10^{-8}
Atterberg Limits			
Liquid Limit (%)			
Plastic Limit (%)			
Plasticity Index			

Foth & Van Dyke

Client: McDonald-Maas & Assoc.R 001505
Scope I.D.: 90M86Project: Slurry Wall - BFI Zion Facility Page: 1Prepared by: Karl SchuldesDate: 11/27/90Checked by: Robert R. RouseDate: 12/31/90

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: 1Test Performed In General Accordance Of: ASTM: D422

General Data:

Sample Location: STA. 25+00Date Sampled: 11/10/90Sample Number: WH-BF-1Dated Received: 11/19/90

Depth of Sample:

Source of Sample: In PlaceSampled by: Tim Ambrosius of McDonald-Maas Munsell Color Code: 10 YR. 4/2Sample Designated For: Slurry Wall

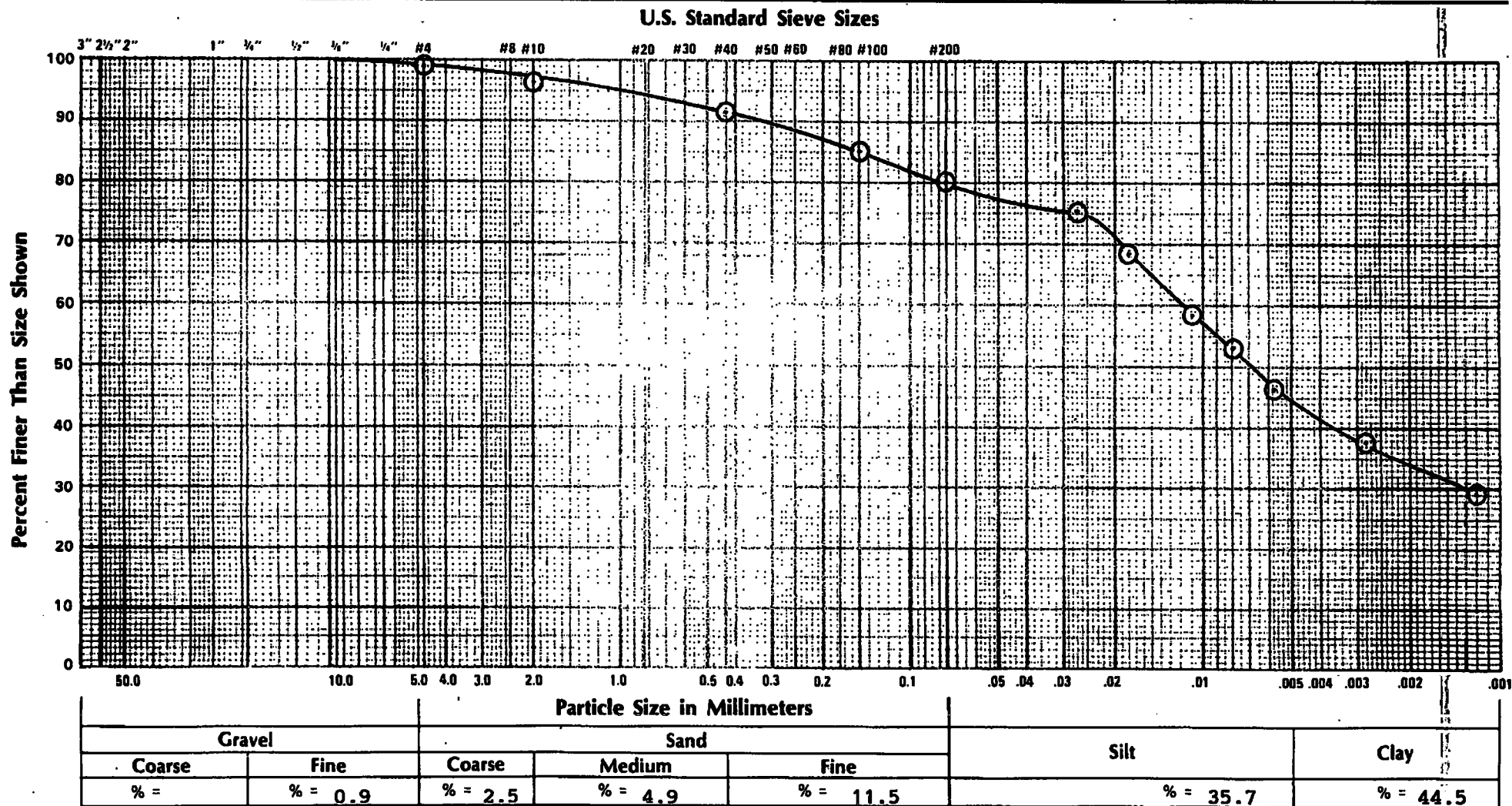
Laboratory Data:

Date Tested: November 27 to 30, 199024 Hrs. Turn Around X Yes NoTest Performed by: KASWashed Gradation X Yes NoWeight of Test Sample 534.3 Grams

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½					
1					
¾					
½					
3/8	0	0	100		
#4	4.7	0.9	99.1		
10	13.2	2.5	96.6		
40	26.1	4.9	91.7		
100	34.6	6.5	85.2		
200	27.0	5.1	80.1	50-100	
Pan	428.5	80.2			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE

Location Sampled: WH-BF-1; Sta. 25+00Elev. or Depth: _____ Date Sampled: 11/10/90Sample Source: In PlaceSampled Moisture Content (%): 43.6 Report No.: 1Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, dark grayish brown (CL)Atterberg Limits: LL 34.4 PL 15.3 PI 19.1Munsell Color Code: 10 YR. 4/2Date Received: 11/19/90

Coefficients: Cc = _____ Cu = _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86Project: Slurry Wall-BFI Zion Facility Page: 2Prepared by: Perry O. Kepler Date: 12/7/90Checked by: Robert B. Rouse Date: 12/31/90

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: R 001507 90M86
Project: Slurry Wall-BFI Zion Facility Page: 11
Prepared by: Karl Schuldes Date: 11/27/90
Checked by: Robert R. Rouse Date: 12/31/90

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: 2

Test Performed In General Accordance Of: ASTM: D422

General Data:

Sample Location: STA. 24+00 Date Sampled: 11/12/90
Sample Number: WH-BF-2 Dated Received: 11/19/90
Depth of Sample: Source of Sample: In Place
Sampled by: Tim Ambrosius of McDonald-Maas Munsell Color Code: 10 YR. 4/2
Sample Designated For: Slurry Wall

Laboratory Data:

Date Tested November 27 to 30, 1990 24 Hrs. Turn Around Yes ☒ No
Test Performed by: KAS Washed Gradation X ☒ Yes ☐ No

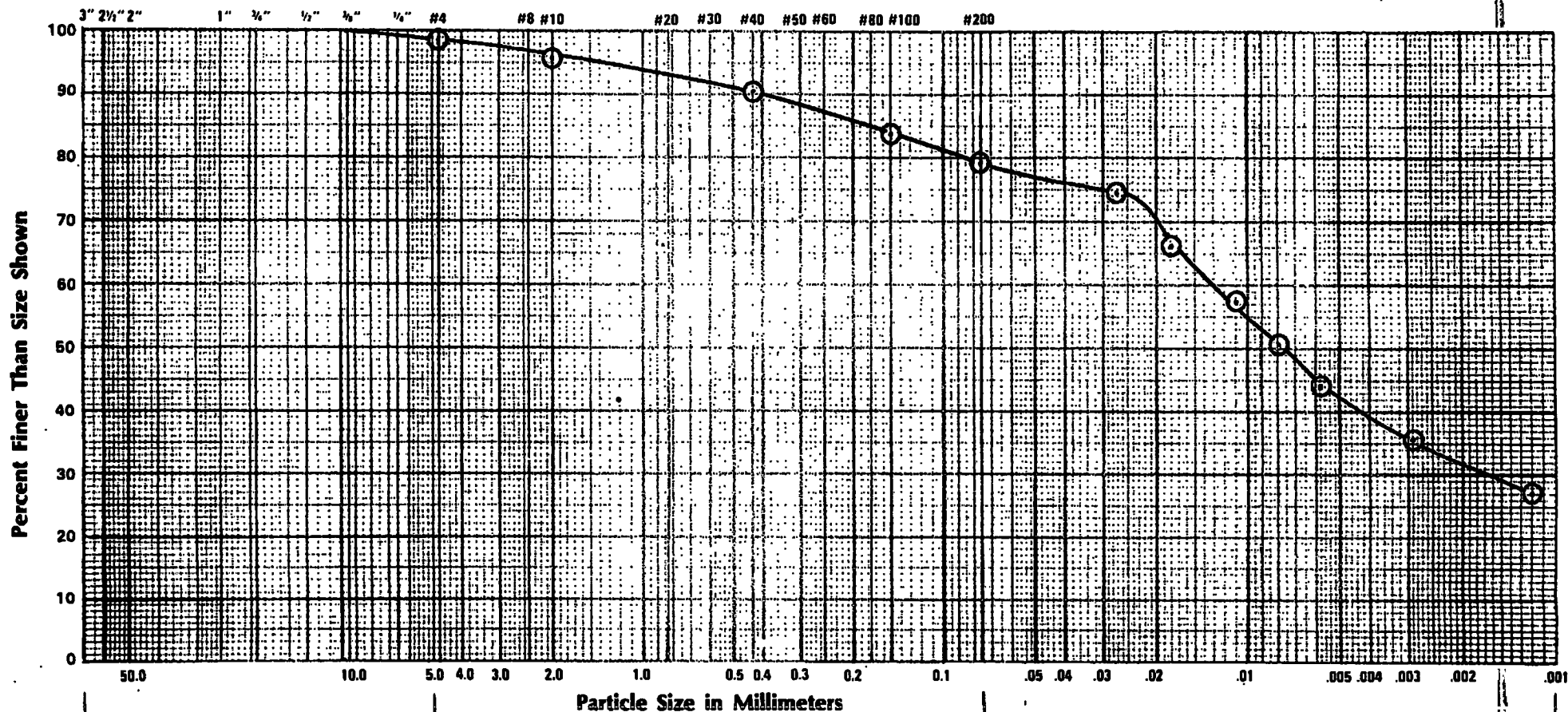
Weight of Test Sample 412.4 Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½					
1					
¾					
½					
3/8	0	0	100		
#4	5.1	1.2	98.8		
10	11.9	2.9	95.9		
40	23.5	5.7	90.2		
100	25.9	6.3	83.9		
200	19.3	4.7	79.2	50-100	
Pan	326.4	79.1			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE

U.S. Standard Sieve Sizes



Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		
% =	% = 1.2	% = 2.9	% = 5.7	% = 11.1	% = 36.6	% = 42.5

Location Sampled: WH-BF-2; STA. 24+00

Elev. or Depth: _____ Date Sampled: 11/12/90

Sample Source: In Place

Sampled Moisture Content (%): 31.6

Report No.: 2

Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, dark grayish brown (CL)

Atterberg Limits: LL 31.4 PL 14.6 PI 16.8

Munsell Color Code: 10 YR. 4/2

Date Received: 11/19/90

Coefficients: Cc = _____ Cu = _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86

Project: Slurry Wall-BFI Zion Facility Page: 2

Prepared by: Perry O. Kepler Date: 12/7/90

Checked by: Robert R. Rouse Date: 12/31/90

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope B-0045090M86
Project: Slurry Wall-BFI Zion Facility Page: 1
Prepared by: Karl Schuldes Date: 11/27/90
Checked by: Robert R. Rouse Date: 12/31/90

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: 3

Test Performed In General Accordance Of: ASTM: D422

General Data:

Sample Location: STA. 23+00 Date Sampled: 11/13/90
Sample Number: WH-BF-3 Dated Received: 11/19/90
Depth of Sample: Source of Sample: In Place
Sampled by: Tim Ambrosius of McDonald-Maas Munsell Color Code: 10 YR. 4/2
Sample Designated For: Slurry Wall

Laboratory Data:

Date Tested: November 27 to 30, 1990 24 Hrs. Turn Around Yes ☒ No
Test Performed by: KAS Washed Gradation X Yes No

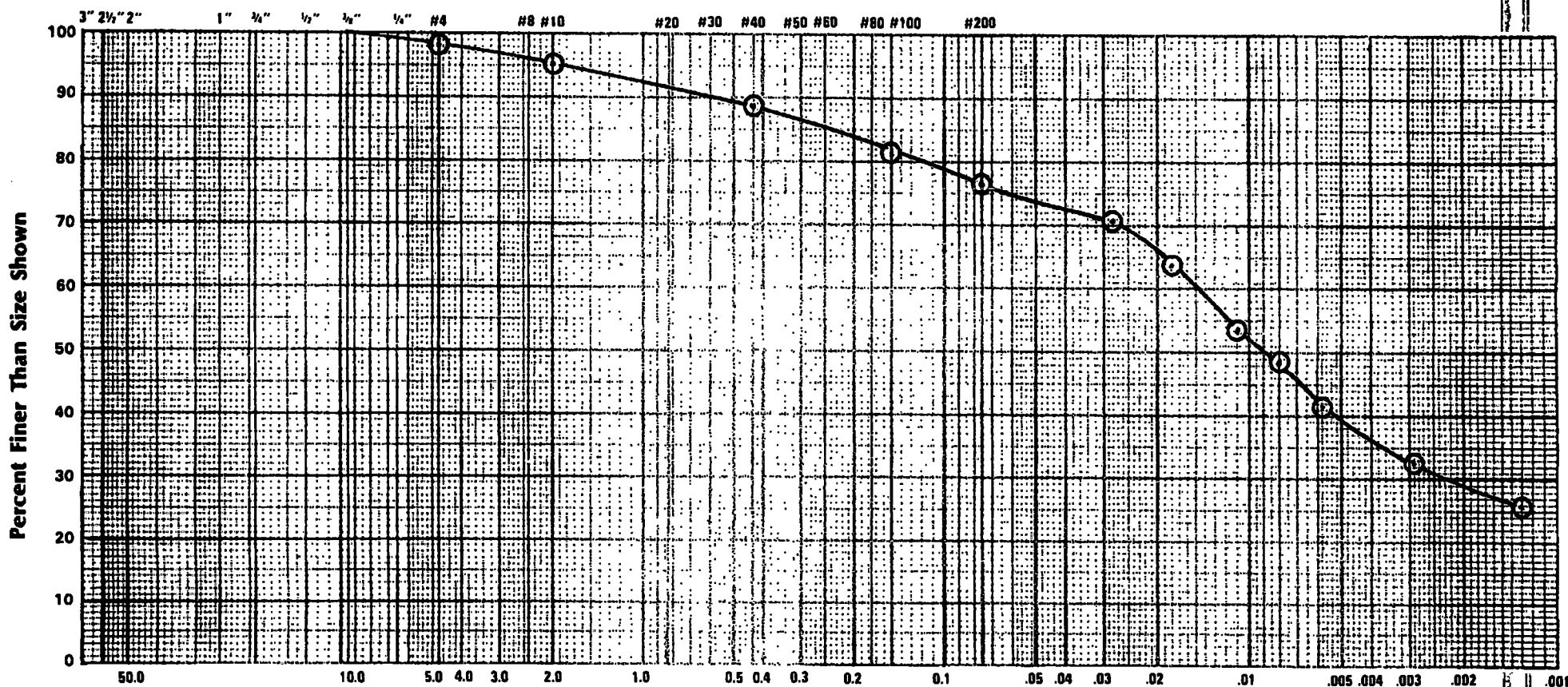
Weight of Test Sample 550.9 Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½					
1					
¾					
½					
3/8	0	0	100		
#4	9.8	1.8	98.2		
10	16.9	3.1	95.1		
40	34.7	6.3	88.8		
100	39.7	7.2	81.6		
200	27.4	5.0	76.6	50-100	
Pan	422.5	76.7			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE

U.S. Standard Sieve Sizes



Particle Size in Millimeters

Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		
% =	% = 1.8	% = 3.1	% = 6.3	% = 12.1	% = 37.2	% = 39.5

Location Sampled: WH-BF-3; STA 23+00

Elev. or Depth: _____ Date Sampled: 11/13/90

Sample Source: In Place

Sampled Moisture Content (%): 39.2 Report No.: 3

Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, dark grayish brown (CL)

Atterberg Limits: LL 31.6 PI 15.0 PI 16.6

Munsell Color Code: 10 YR. 4/2

Date Received: 11/19/90

Coefficients: Cc = _____ Cu = _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86

Project: Slurry Wall-BFI Zion Facility Page: 2

Prepared by: Perry O. Kepler Date: 12/7/90

Checked by: Robert R. Rouse Date: 12/31/90

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope: 005190M86
Project: Slurry Wall-BFI Zion Facility Page: 1
Prepared by: Karl Schuldes Date: 11/27/90
Checked by: Robert R. Rouse Date: 12/31/90

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: 4

Test Performed In General Accordance Of: ASTM: D422

General Data:

Sample Location: STA. 22+00 Date Sampled: 11/13/90
Sample Number: WH-BF-4 Dated Received: 11/19/90
Depth of Sample: Source of Sample: In Place
Sampled by: Tim Ambrosius of McDonald & Maas Munsell Color Code: 10 YR. 4/2
Sample Designated For: Slurry Wall

Laboratory Data:

Date Tested: November 27 to 30, 1990 24 Hrs. Turn Around Yes ☒ No
Test Performed by: KAS Washed Gradation ☒ Yes No

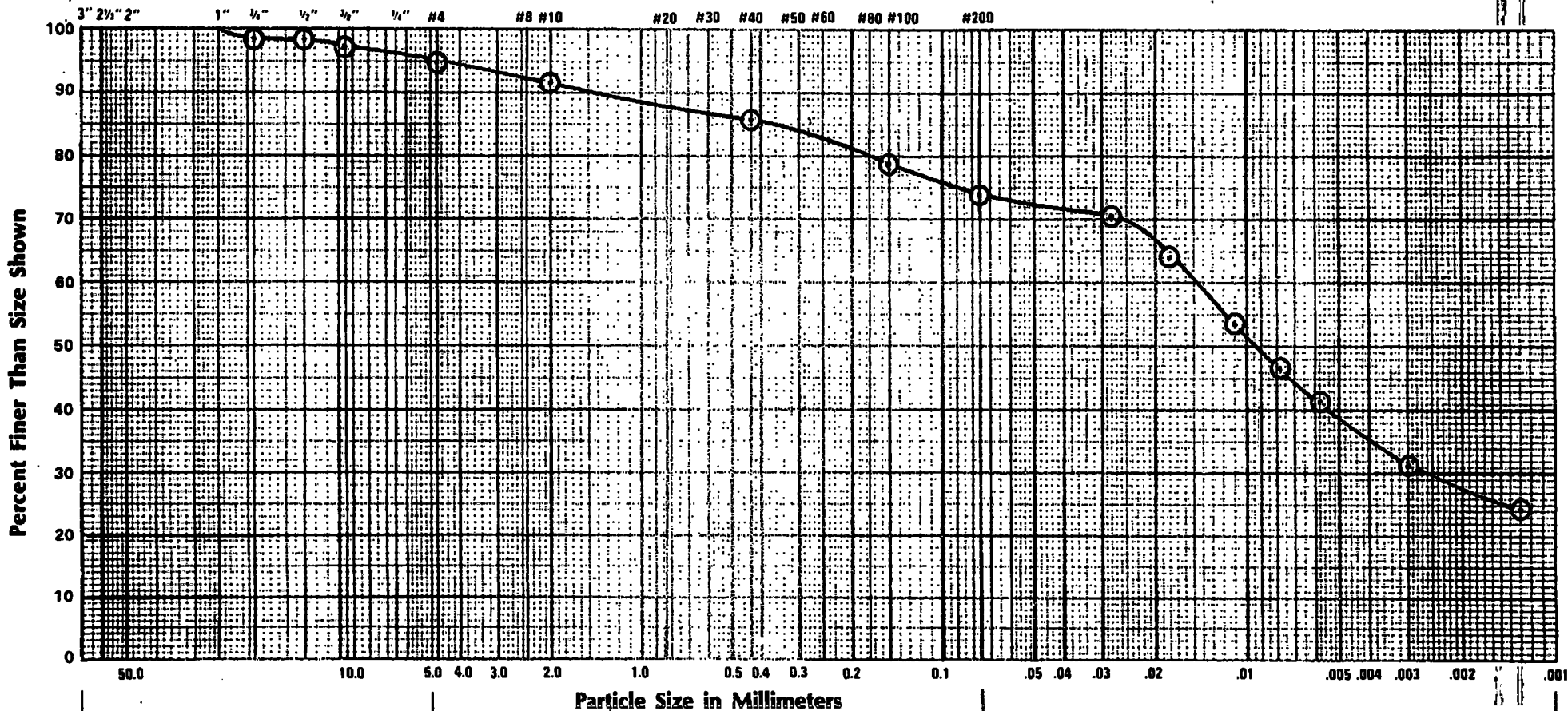
Weight of Test Sample 636.4 Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½					
1	0	0	100		
¾	11.1	1.7	98.3		
½	0	0.0	98.3		
⅜	6.8	1.1	97.2		
#4	14.5	2.3	94.9		
10	19.4	3.0	91.9		
40	39.5	6.2	85.7		
100	44.8	7.0	78.7		
200	30.3	4.8	73.9	50-100	
Pan	469.9	73.8			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE

U.S. Standard Sieve Sizes



Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		
% = 1.7	% = 3.4	% = 3.0	% = 6.2	% = 11.9	% = 35.3	% = 38.5

Location Sampled: WH-BF-4; STA. 22+00 Elev. or Depth: _____ Date Sampled: 11/13/90
Sample Source: In Place Sampled Moisture Content (%): 29.2 Report No.: 4
Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, a little gravel, dark grayish brown (CL)

Atterberg Limits: LL 30.9 PL 15.1 PI 15.8

Munsell Color Code: 10 YR. 4/2

Date Received: 11/19/90

Coefficients: Cc = _____ Cu = _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86

Project: Slurry Wall-BFT Zion Facility Page: 2

Prepared by: Perry O. Kepler Date: 12/7/90

Checked by: Robert R. Rouse Date: 12/31/90

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope 10045130M86
Project: Slurry Wall-BFI Zion Facility Page: 1
Prepared by: Karl Schuldes Date: 11/27/90
Checked by: Robert R. Rouse Date: 12/31/90

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: 5

Test Performed In General Accordance Of: ASTM: D422

General Data:

Sample Location: Sta. 21+00 Date Sampled: 11/14/90
Sample Number: WH-BF-5 Dated Received: 11/19/90
Depth of Sample: Source of Sample: In Place
Sampled by: Tim Ambrosius of McDonald-Maas Munsell Color Code: 10 YR. 4/2
Sample Designated For: Slurry Wall

Laboratory Data:

Date Tested November 27 to 30, 1990 24 Hrs. Turn Around Yes ☒ No
Test Performed by: KAS Washed Gradation Yes ☒ No

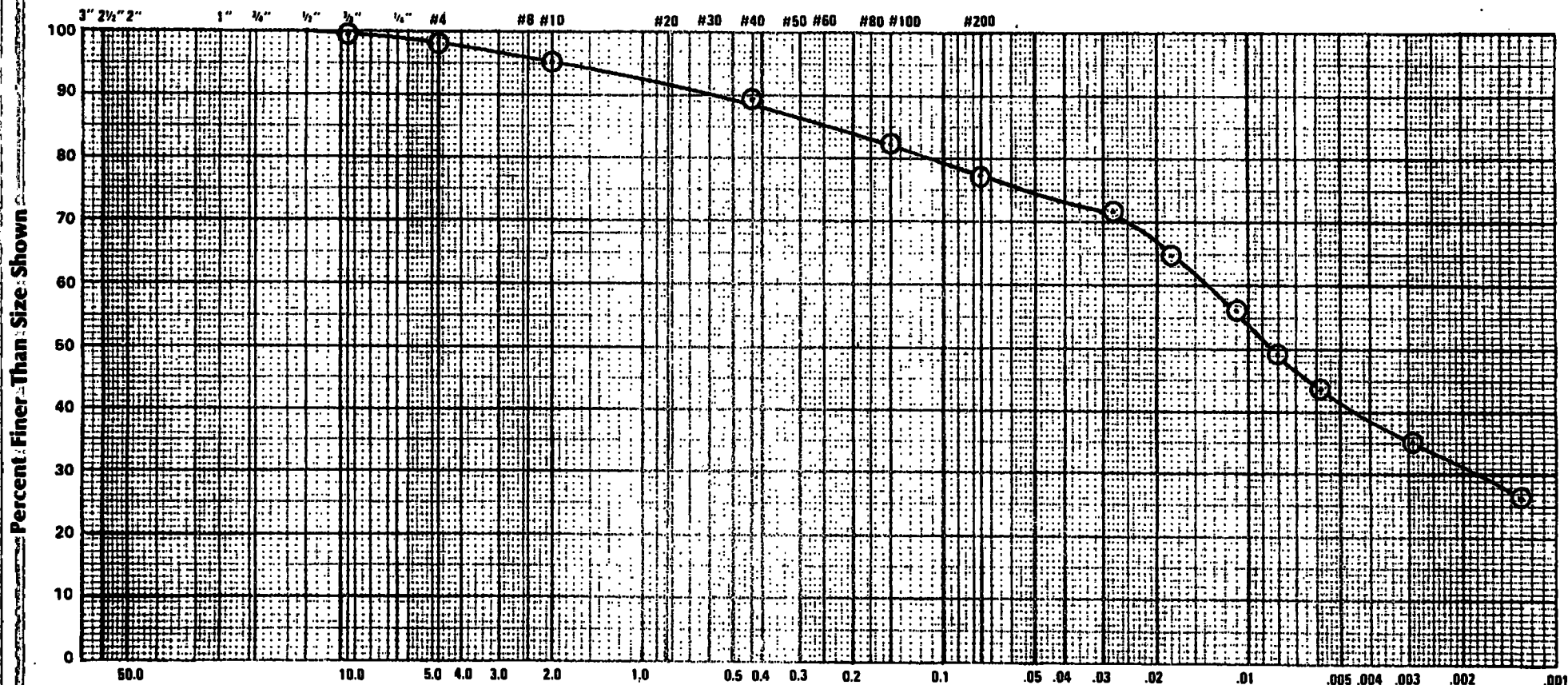
Weight of Test Sample 533.4 Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½					
1					
¾					
1/2	0	0	100		
3/8	2.1	0.4	99.6		
#4	7.9	1.5	98.1		
10	14.9	2.8	95.3		
40	32.1	6.0	89.3		
100	37.3	7.0	82.3		
200	26.0	4.9	77.4	50-100	
Pan	412.3	77.3			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE

U.S. Standard Sieve Sizes



		Particle Size in Millimeters				
Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		
% =	% = 1.9	% = 2.8	% = 6.0	% = 12.0	% = 35.8	% = 41.5

Location Sampled: WH-BF-5; Sta. 21+00 Elev. or Depth: _____ Date Sampled: 11/14/90

Sample Source: In Place Sampled Moisture Content (%): 38.4 Report No.: 5

Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, dark grayish brown (CL)

Atterberg Limits: LL 34.8 PI 15.3 PI 19.5

Munsell Color Code: 10 YR. 4/2

Date Received: 11/19/90

Coefficient of Uniformity = _____ Cu = _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86

Project: Slurry Wall-BFI Zion Facility Page: 2

Prepared by: Perry O. Kepler Date: 12/7/90

Checked by: Robert R. Rowe Date: 12/31/90

R1001514

Foth & Van Dyke

Client: McDonald-Maas & Assoc.

R 0015190M86
Scope I.D.: 1

Project: Slurry Wall-BFI Zion Facility

Page: 1

Prepared by: Karl Schuldes

Date: 11/27/90

Checked by: Robert R. Rouse

Date: 12/31/90

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: 6

Test Performed In General Accordance Of: ASTM: D422

General Data:

Sample Location: STA. 20+00

Date Sampled: 11/14/90

Sample Number: WH-BF-6

Dated Received: 11/19/90

Depth of Sample:

Source of Sample: In Place

Sampled by: Tim Ambrosius of McDonald-Maas Munsell Color Code: 10 YR. 4/2

Sample Designated For: Slurry Wall

Laboratory Data:

Date Tested November 27 to 30, 1990

24 Hrs. Turn Around ☐ Yes ☒ No

Test Performed by: KAS

Washed Gradation ☒ Yes ☐ No

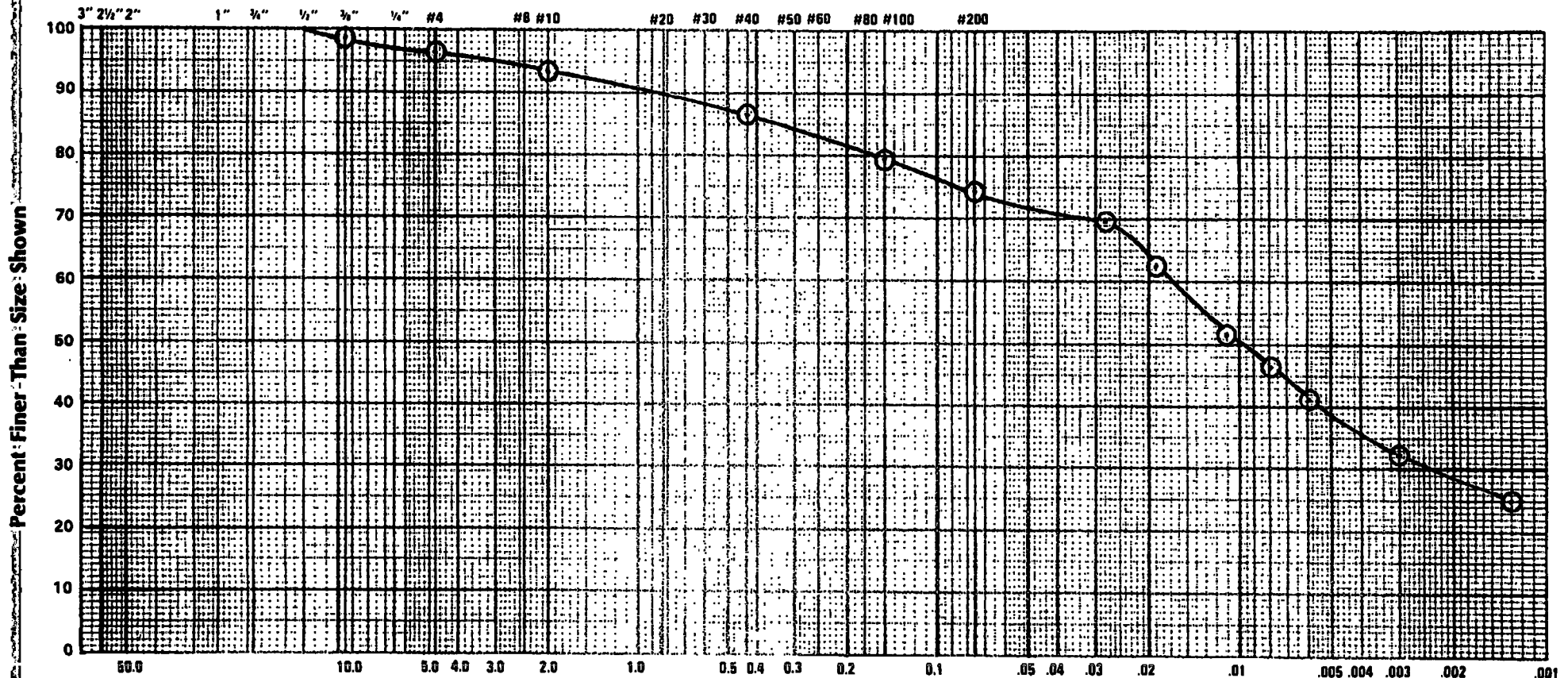
Weight of Test Sample 511.3 Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					
1½					
1					
¾					
1/2	0	0	100		Approved Landfill
3/8	5.5	1.1	98.9		Plan
#4	13.2	2.6	96.3		
10	14.4	2.8	93.5		
40	34.3	6.7	86.8		
100	37.7	7.4	79.4		
200	26.7	5.2	74.2	50-100	
Pan	379.8	74.2			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE

U.S. Standard Sieve Sizes



		Particle Size in Millimeters			Silt	Clay
Gravel		Sand				
Coarse	Fine	Coarse	Medium	Fine		
% =	% = 3.7	% = 2.8	% = 6.7	% = 12.6	% = 35.7	% = 38.5

Location Sampled: WH-BF-6; STA. 20+00 Elev. or Depth: _____ Date Sampled: 11/14/90
 Sample Source: In Place Sampled Moisture Content (%): 32.7 Report No.: 6
 Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, a little gravel, dark grayish brown (CL)

Atterberg Limits: LL 32.6 PL 14.8 PI 17.8

Munsell Color Code: 10 YR. 4/2

Date Received: 11/19/90

Coefficient of Uniformity = _____ Cu = _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86

Project: Slurry Wall-BFI Zion Facility Page: 2

Prepared by: Perry O. Kepler Date: 12/7/90

Checked by: Robert R. Rouse Date: 12/31/90

R1001516

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: R0015170M86
Project: Slurry Wall-BFI Zion Facility Page: 1
Prepared by: Karl Schuldes Date: 11/27/90
Checked by: Robert R. Rouse Date: 12/31/90

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: 7

Test Performed In General Accordance Of: ASTM: D422

General Data:

Sample Location: STA. 19+00 Date Sampled: 11/15/90
Sample Number: WH-BF-7 Dated Received: 11/19/90
Depth of Sample: Source of Sample: In Place
Sampled by: Tim Ambrosius of McDonald-Maas Munsell Color Code: 10 YR. 4/2
Sample Designated For: Slurry Wall

Laboratory Data:

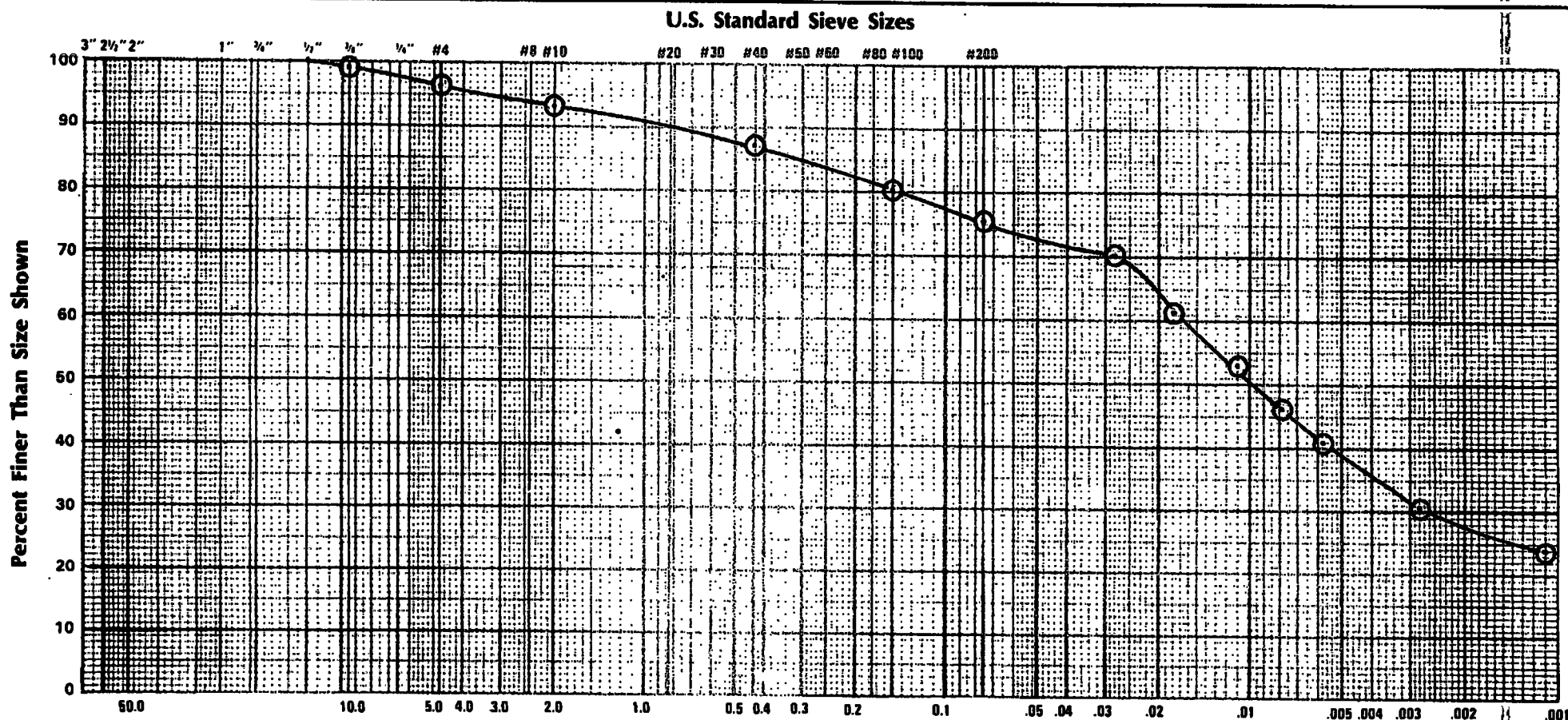
Date Tested November 27 to 30, 1990 24 Hrs. Turn Around Yes ☒ No
Test Performed by: KAS Washed Gradation X Yes No

Weight of Test Sample 582.5 Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½					
1					
¾					
1/2	0	0	100		
3/8	4.4	0.8	99.2		
#4	16.5	2.8	96.4		
10	17.8	3.1	93.3		
40	35.0	6.0	87.3		
100	40.9	7.0	80.3		
200	28.8	4.9	75.4	50-100	
Pan	438.3	75.2			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE



Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		
% =	% = 3.6	% = 3.1	% = 6.0	% = 12.1	% = 36.2	% = 39.0

Location Sampled: WH-BR-7; Sta. 19+00 Elev. or Depth: _____ Date Sampled: 11/15/90

Sample Source: In Place Sampled Moisture Content (%): 33.0 Report No.: 7

Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, a little gravel, dark grayish brown (CL)

Atterberg Limits: LL 33.9 PL 15.0 PI 18.9

Munsell Color Code: 10 YR. 4/2

Date Received: 11/19/90

Coefficients: Cc = _____ Cu = _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86

Project: Slurry Wall-BFI Zion Facility Page: 2

Prepared by: Perry O. Kepler Date: 12/7/90

Checked by: Robert R. Rouse Date: 12/31/90

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope 1.D.1990M86
Project: Slurry Wall-BFI Zion Facility Page: 1
Prepared by: Karl Schuldes Date: 11/27/90
Checked by: Robert R. Rouse Date: 12/31/90

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: 8

Test Performed In General Accordance Of: ASTM: D422

General Data:

Sample Location: Sta. 18+00 Date Sampled: 11/16/90
Sample Number: WH-BF-8 Dated Received: 11/19/90
Depth of Sample: Source of Sample: In Place
Sampled by: Tim Ambrosius of McDonald-Maas Munsell Color Code: 10 YR. 4/2
Sample Designated For: Slurry Wall

Laboratory Data:

Date Tested: November 27 to 30, 1990 24 Hrs. Turn Around Yes ☒ No
Test Performed by: KAS Washed Gradation X Yes No

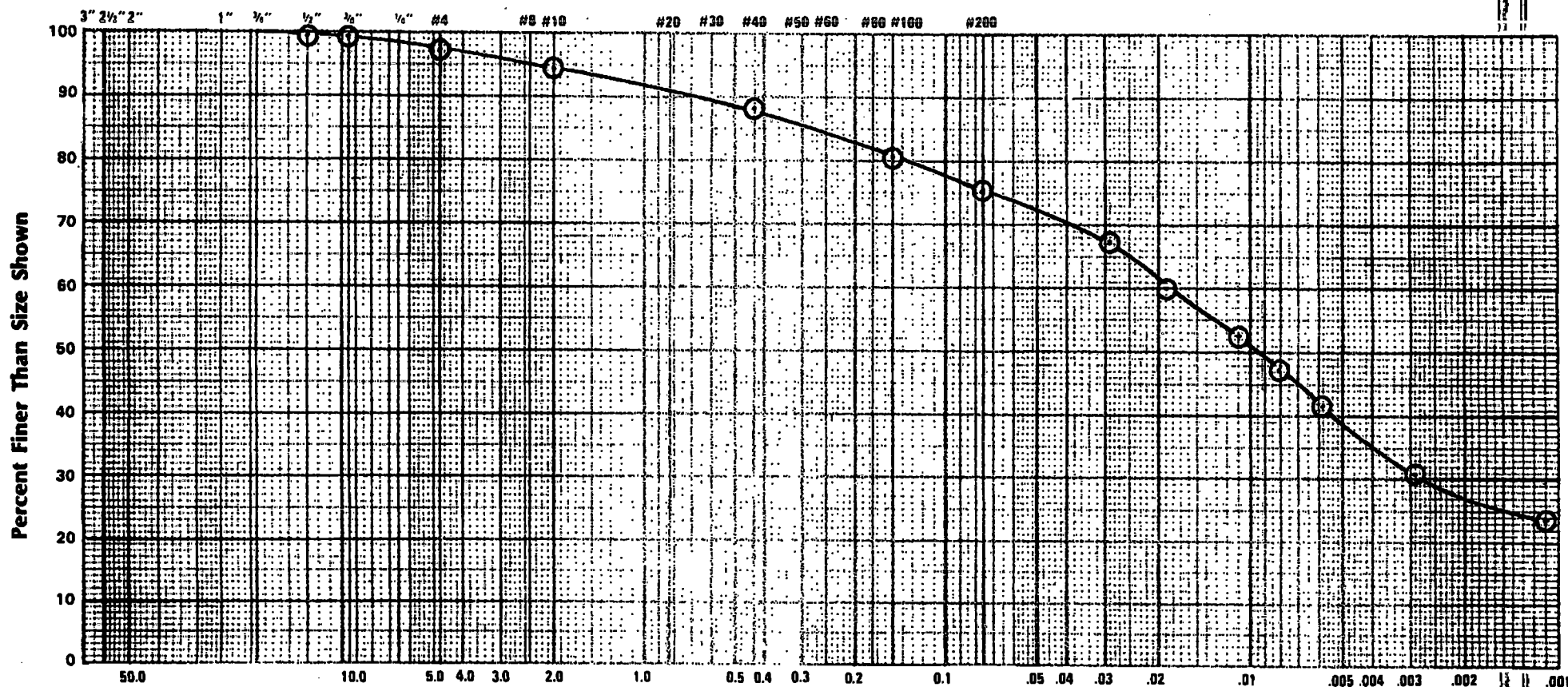
Weight of Test Sample 642.7 Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½					
1					
¾	0	0	100		
1/2	2.7	0.4	99.6		
3/8	0	0.0	99.6		
#4	14.8	2.3	97.3		
10	17.2	2.7	94.6		
40	41.5	6.5	88.1		
100	48.2	7.5	80.6		
200	34.2	5.3	75.3	50-100	
Pan	483.7	75.3			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE

U.S. Standard Sieve Sizes



Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		
% =	% = 2.7	% = 2.7	% = 6.5	% = 12.8	% = 36.8	% = 38.5

Location Sampled: WH-BF-8; Sta. 18+00

Elev. or Depth: _____ Date Sampled: 11/16/90

Sample Source: In Place

Sampled Moisture Content (%): 30.9 Report No.: 8

Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, dark grayish brown (CL)

Atterberg Limits: LL 32.7 PL 15.6 PI 17.1

Munsell Color Code: 10 YR. 4/2

Date Received: 11/19/90

Coefficients: Cc = _____ Cu = _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86

Project: Slurry Wall-BFI Zion Facility Page: 2

Prepared by: Perry O. Kepler Date: 12/7/90

Checked by: Robert R. Rouse Date: 12/31/90

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope R 00152 90M86
Project: Slurry Wall-BFI-Zion Facility Page: 1
Prepared by: Karl Schuldes Date: 11/27/90
Checked by: Robert R. Rouse Date: 12/31/90

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: 9

Test Performed In General Accordance Of: ASTM: D422

General Data:

Sample Location: STA. 17+00 Date Sampled: 11/15/90
Sample Number: WH-BF-9 Dated Received: 11/19/90
Depth of Sample: Source of Sample: In Place
Sampled by: Tim Ambrosius of McDonald-Maas Munsell Color Code: 10 YR. 4/2
Sample Designated For: Slurry Wall

Laboratory Data:

Date Tested: November 27 to 30, 1990 24 Hrs. Turn Around Yes ☒ No
Test Performed by: KAS Washed Gradation X Yes No

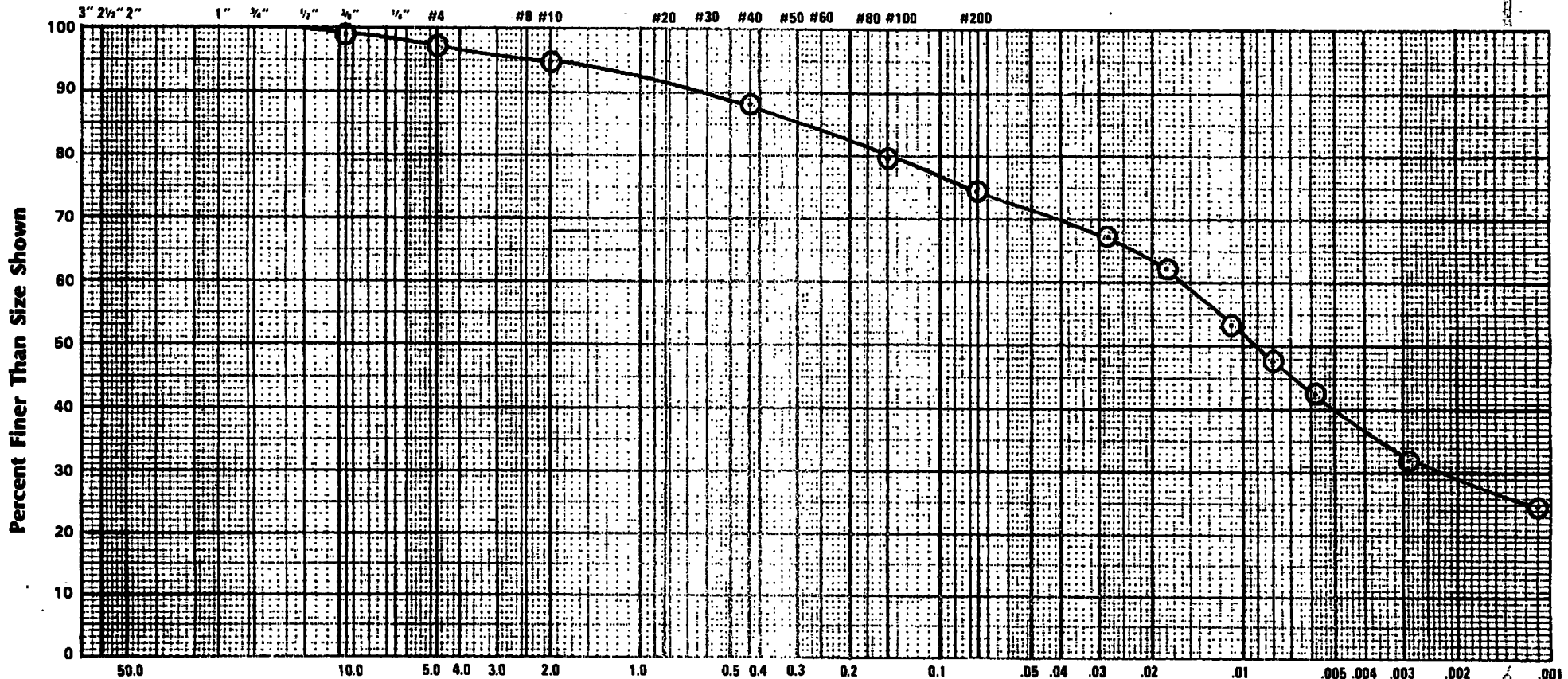
Weight of Test Sample 547.8 Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½					
1					
¾					
1/2	0	0	100		
3/8	4.7	0.9	99.1		
#4	9.0	1.6	97.5		
10	14.1	2.6	94.9		
40	37.2	6.8	88.1		
100	45.3	8.3	79.8		
200	29.9	5.5	74.3	50-100	
Pan	407.1	74.3			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE

U.S. Standard Sieve Sizes



		Particle Size in Millimeters				
Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		
% =	% = 2.5	% = 2.6	% = 6.8	% = 13.8	% = 34.3	% = 40.0

Location Sampled: WH-BF-9; STA. 17+00 Elev. or Depth: _____ Date Sampled: 11/15/90

Sample Source: In Place Sampled Moisture Content (%): 41.9 Report No.: 9

Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, dark grayish brown (CL)

Atterberg Limits: LL 34.2 PL 14.7 PI 19.5

Munsell Color Code: 10 YR. 4/2

Date Received: 11/19/90

Coefficients: Cc = _____ Cu = _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86

Project: Slurry Wall-BFI Zion Facility Page: 2

Prepared by: Perry O. Kepler Date: 12/7/90

Checked by: Robert R. Rouse Date: 12/31/90

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: B-0045230M86
Project: Slurry Wall-BFI Zion Facility Page: 1
Prepared by: Karl Schuldes Date: 11/27/90
Checked by: Robert R. Rouse Date: 12/31/90

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: 10

Test Performed In General Accordance Of: ASTM: D422

General Data:

Sample Location: STA. 16+00 Date Sampled: 11/16/90
Sample Number: WH-BF-10 Dated Received: 11/19/90
Depth of Sample: _____ Source of Sample: In Place
Sampled by: Tim Ambrosius of McDonald-Maas Munsell Color Code: 10 YR. 4/2
Sample Designated For: Slurry Wall

Laboratory Data:

Date Tested November 27 to 30, 1990 24 Hrs. Turn Around Yes ☒ No
Test Performed by: KAS Washed Gradation X Yes No

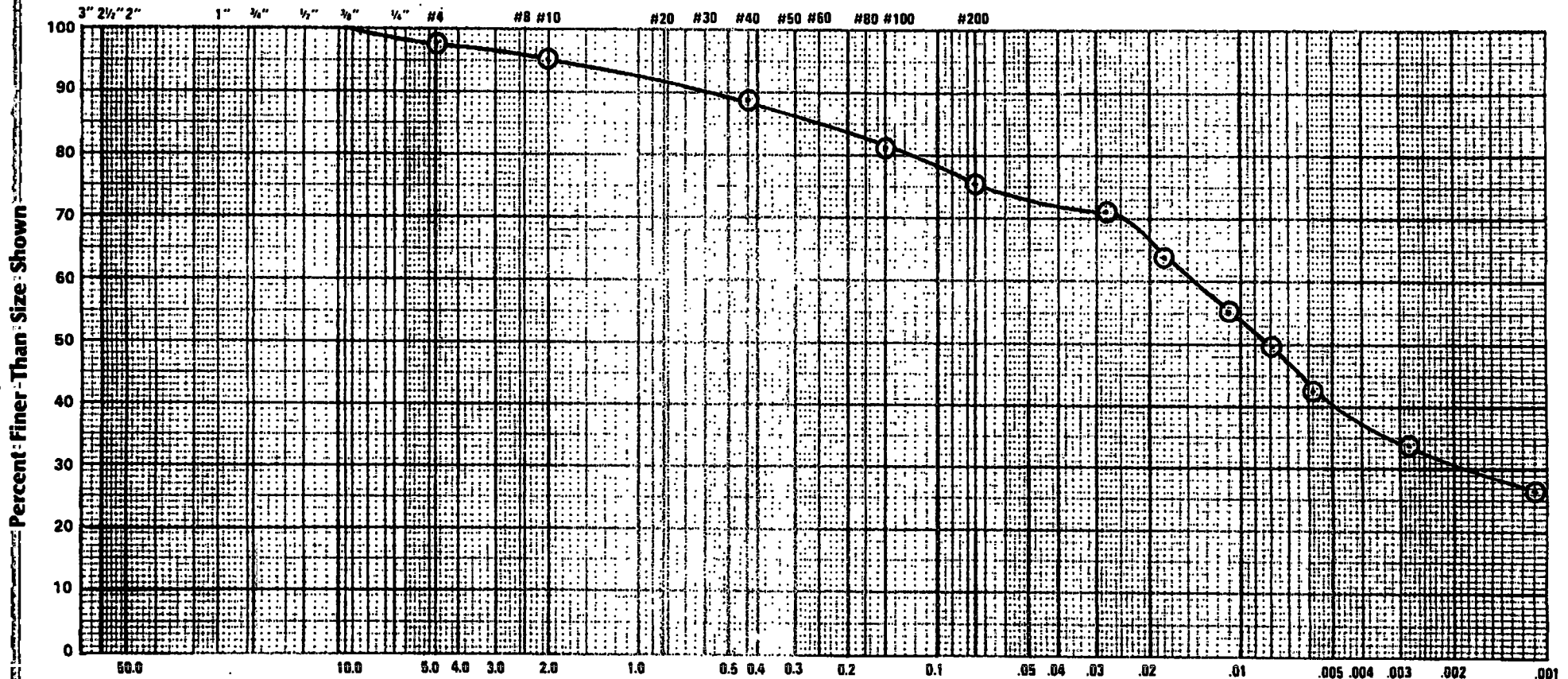
Weight of Test Sample 499.0 Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½					
1					
¾					
½					
3/8	0	0	100		
#4	10.8	2.2	97.8		
10	12.7	2.5	95.3		
40	31.8	6.4	88.9		
100	39.1	7.8	81.1		
200	27.1	5.4	75.7	50-100	
Pan	377.4	75.6			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE

U.S. Standard Sieve Sizes



Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		
% =	% = 2.2	% = 2.5	% = 6.4	% = 13.3	% = 35.1	% = 40.5

Location Sampled: WH-BF-10 : STA. 16+00. Elev. or Depth: _____ Date Sampled: 11/16/90

Sample Source: In Place Sampled Moisture Content (%): 34.0 Report No.: 10

Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, dark grayish brown (CL)

Atterberg Limits: LL 34.4 PL 16.4 PI 18.0

Munsell Color Code: 10 YR. 4/2

Date Received: 11/19/90

Coefficient of Uniformity = _____ Cu = _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86

Project: Slurry Wall-BFI Zion Facility Page: 2

Prepared by: Perry O. Kepler Date: 12/7/90

Checked by: Robert R. Rouse Date: 12/31/90

R1001524

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope: 00152590M86
Project: Slurry Wall-BFI Zion Facility Page: 1
Prepared by: Karl Schuldes Date: 11/27/90
Checked by: Robert R. Rouse Date: 12/31/90

REPORT OF: SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor:

Report Number: 11

Test Performed In General Accordance Of: ASTM: D422

General Data:

Sample Location: STA. 15+00 Date Sampled: 11/17/90
Sample Number: WH-BF-11 Dated Received: 11/19/90
Depth of Sample: Source of Sample: In Place
Sampled by: Tim Ambrosius of McDonald-Maas Munsell Color Code: 10 YR. 4/2
Sample Designated For: Slurry Wall

Laboratory Data:

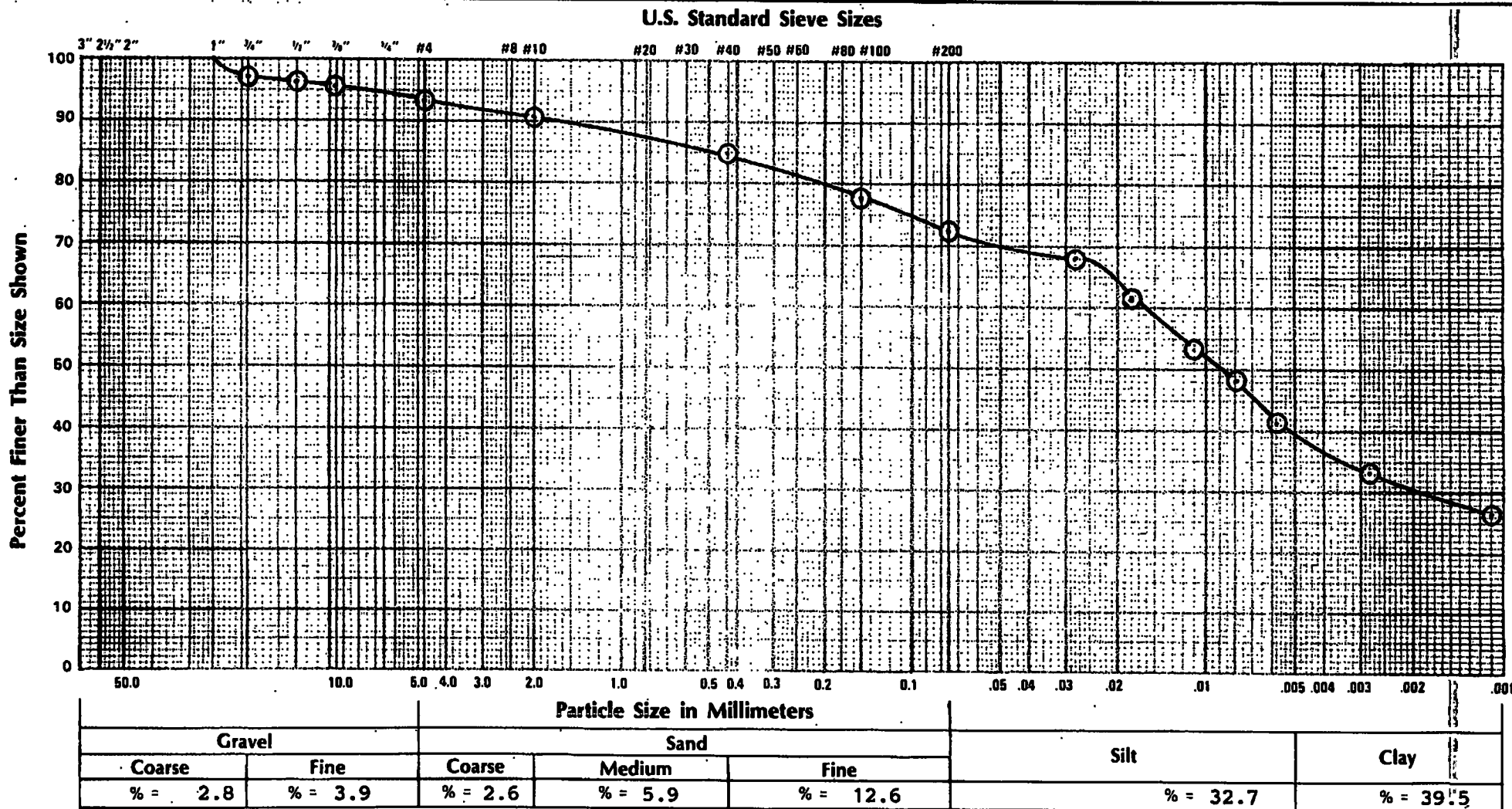
Date Tested: November 27 to 30, 1990 24 Hrs. Turn Around Yes ☒ No
Test Performed by: KAS Washed Gradation X Yes No

Weight of Test Sample 499.6 Grams.

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					Approved Landfill Plan
1½"					
1"	0	0	100		
¾"	14.2	2.8	97.2		
½"	4.5	0.9	96.3		
3/8"	2.9	0.6	95.7		
#4	12.2	2.4	93.3		
#10	13.0	2.6	90.7		
#40	29.7	5.9	84.8		
#100	35.5	7.1	77.7		
#200	26.4	5.3	72.4	50-100	
Pan	360.9	72.2			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE

Location Sampled: WH-BF-11; STA. 15+00Elev. or Depth: _____ Date Sampled: 11/17/90Sample Source: In PlaceSampled Moisture Content (%): 51.5 Report No.: 11Soil Classification (ASTM: D2487): LEAN CLAY W/SAND, a little gravel, dark grayish brown (CL)Atterberg Limits: LL 44.6 PL 15.1 PI 29.5Munsell Color Code: 10 YR. 4/2Date Received: 11/19/90

Coefficients: Cc = _____ Cu = _____

Foth & Van Dyke

Client: McDonald-Maas & Assoc. Scope I.D.: 90M86Project: Slurry Wall-BFI-Zion Facility Page: 2Prepared by: Perry O. Kepler Date: 12/7/90Checked by: Robert R. Rowe Date: 12/31/90